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AUST.-C.S.I.R.-Radiophysics, Division of

Air warning set J.23.
27pp., figs. April 1, 1942

(Report no. PD.17/1)

N.S.L. 762

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SERIAL ORDER

AW mk I
Final Manual

The printing this side need only be used if the so-called "Reverse" Filing is practised (this method is to file the letters face downwards so that the earliest date appears on top).

File No.	Name	Address	Date
			From 19
			to 19
			Reference



1st April, 1942.

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AIR WARNING SET J.23

UNCLASSIFIED

OPERATION AND TESTING DATAPart IA. GENERAL.

The equipment comprises a transmitter cubicle, receiver cubicle, T-R switch unit, and 36 element array. (See Block Schematic D.1608). The operating frequency is 200 Mc/s., pulse recurrence frequency is 50 c/s., and pulse length is 20 μ secs.

The following is a list of drawings relevant to the set.

In envelope at front of report	B.1408	K61 General Assembly
SA	D.1462	Aerial System
	C.1594	Transmitter Cubicle Wiring K66
	C.2245	Receiver " " K69
	D.2211	Transmitter Unit Schematic U.431
	D.2210	Transmitter Power Supply, Schematic U434 - U436.
	D.2209	Modulator and Power Supply, Schematic U.557.
In envelope at front of report	B.2212	Timing Osc., Time Base, C.R.O. and Pulse Shaper Schematic U.453.
SA	D.2213	Time Base and Receiver Power Supply Schematic U.456.
	P.1602	C.R.O. Power Supply Schematic U.510
	C.1694	Temporary Receiver Schematic U.556
	D.1695	Temporary Receiver Code U.556
	D.1608	Block Schematic
	P.1634	Wave Forms
	P.1635	" "
	P.1636	" "
	P.1637	" "

B. CIRCUIT OPERATION

UNCLASSIFIED

1. Timing Oscillator, Time Base and C.R.O.

Referring to D.1608 and B.2212, V_4 and V_5 (6J7G's) form a multivibrator pair whose recurrence frequency is synchronised to the mains by injecting a 50 c/s. voltage via C_7 . The output at the plate of V_5 is a distorted square wave, the negative half of which is used to initiate the sequence of events in the set.

The square wave is fed to the grid of V_3 (6J7G), and appears at the grid of V_2 (807) as a positive impulse. V_2 is normally cut off and conducts only when this positive impulse arrives, producing a negative pulse of 20 μ secs duration across the tuned circuit L_1 , C_1 . The diode V_1 (6X5GT) serves to suppress the train of oscillations which would normally occur after the negative pulse. This negative pulse is then fed across to the modulator and triggers off the transmitter.

Simultaneously with the above, the square wave is fed to a switching valve V_6 (807), cutting off its plate current and allowing the condenser C_{14} to charge through R_{32} . The potentials on C_{14} and the range potentiometer R_{35} are fed to the grids of a "long tail" push pull amplifier V_7 , V_8 (807's) whose output is fed to the C.R.O. horizontal plates, producing a time base.

The components R_{32} , C_{14} , R_{34} , R_{35} form a bridge circuit, and corresponding with any setting of R_{35} , there is an instant of time such that the bridge is "balanced", i.e. amplifier grid potentials are equal, and the spot is passing through the electrical centre of the C.R.O.

R_{35} may hence be graduated directly in miles, and since C_{14} starts to charge at the beginning of the ground

pulse the range is obtained by adjusting R_{35} so that the echo appears at the crosswire.

The switch SW_1 contracts or expands the time base by changing the voltage on the bridge, the length of time base appearing on the screen being 120 miles or 30 miles respectively.

Zero adjustments R_{28} and R_{29} are set so that the minimum potential on C_{14} (i.e. V_6 conducting) is equal to the potential across R_{33} .

The amplifier is balanced by closing SW_3 and adjusting R_{45} so that the plate potentials of V_7 and V_8 are equal, i.e. the spot is at the electrical centre of the C.R.O.

The square wave from V_5 is also fed to an amplifier tube V_9 (6J7G) whose output is fed to the C.R.O. grid and serves to brighten up the working stroke of the time base.

In addition to the normal Focus and Brightness controls for the C.R.O., an auxiliary focus control (screw-driver adjustment) is fitted on the left hand side of the C.R.O. panel. This will only be used, to give a sharply focussed circular spot, when fitting a new C.R.O.

2. Modulator and Transmitter.

Referring to circuits D.2211 and D.2209, the negative pulse from the receiver cubicle is amplified by two 807's and the resulting positive 20 μ sec. pulse is fed to 807 cathode followers, and then to the grids of the 833's. The 833's are connected in the cathode leads of the VT90 oscillator valves and are biased so that the VT90 cannot normally oscillate. The positive pulse from the cathode followers drives the 833 grids into the positive region and allows them to pass the full oscillating current of the

VT90's with a drop of 500 - 1000 volts.

3. Transmitter Power Supply. (See D.2210).

This supply uses AV11 valves in a voltage doubler circuit, the H.T. transformer being tapped Low-Medium-High, corresponding with D.C. output voltages of 6, 8 and 10 K.V. respectively.

The "filaments" switch controls the mains supply to the modulator and the VT90 filament transformer, the latter being also interlocked with the blower.

A time delay relay allows the filaments to heat up before H.T. is applied, and a 50 ohm resistor in the H.T. transformer primary limits the switching on surge. This resistor is shorted out a fraction of a second later by a single pole contactor.

An overload relay set to trip at 10 mA. is connected in the H.T. return lead. This is of the automatic break-manual reset type.

C. OPERATING INSTRUCTIONS.

The transmitter frequency should be set by means of the knob on the front of the box so that the wavemeter neon bulb glows.

The aerial coupling condenser should be adjusted for maximum output as indicated by picking up signal on a test dipole placed near the array. The grid current reading on the monitoring meter should then be approximately .2 (full scale 1 mA.). It will be found that unstable operation may result if the grid current reads more than this value, and the overload trip may operate.

The "High" position on the H.T. switch should be used sparingly, as the increase in output is not great and valves are on the point of flashing over.

The receiver tuning should be checked at frequent intervals, oscillator tuning and the three trimmer adjustments being peaked on a suitable echo.

Time base adjustments are carried out as follows:-

The C.R.O horizontal plates are shorted together with a piece of wire and the vertical crosswire is shifted across over the fluorescent spot. The shorting wire is then removed and the "Test" switch is operated to short the amplifier grids. The "Balance" potentiometer is then adjusted so that the spot appears at the crosswire. The switch is then returned to "Use", and with the range dial turned to zero, the zero adjustments on both contracted and expanded scales are set so that the left hand end of the time base is on the crosswire.

D. VOLTAGE MEASUREMENTS AND WAVEFORMS.

Voltage measurements and waveforms at points throughout the units are attached - Drawings P.1634, P.1635, P.1636 and P.1637.

E. NOMINAL VOLTAGES AND CURRENTS AT TEST POINTS.

U.434 EHT Power Supply.

AV11 Filaments	2.5 V. A.C.
High Tension on Load:	
Low .26 mA.	5.2 KV. D.C.
Medium .38 mA.	<u>7.6 KV.</u> D.C.
High .50 mA.	10.0 KV. D.C.

U.438. Modulator.

807 Filaments	6.3 V. A.C.
833 Filaments	10.0 V. "
High Tension	540 V. D.C.
1st Tap on Potential Divider	130 V. D.C.
2nd Tap on Potential Divider	60 V. D.C.

Panel Meter Readings:

RECT.	.52 mA. D.C.	150
V ₁	.78 mA. D.C.	8.47
V ₂	.78 mA. "	9.58
V ₃	.50 mA. "	3.7
V ₄	.46 mA. "	3.6

Transmitter on Medium Tap:

Left 833	.6 mA. D.C.	5.27
Right 833	.63 mA. "	6.75
VT90 grids	.23 mA. "	12.5

U.431. Transmitter.

VT90 Filaments	8.5 V. A.C.
----------------	-------------

Output measurements using
attenuator U.511 (17 db) and
peak voltmeter U.502.

<u>HT Tap</u>	<u>Peak Volts</u>
Low	
Medium	
High	

U.453. Time Base and C.R.O.

905 C.R.O. Filament	2.5 V. A.C.
Valves V ₁ to V ₉ "	6.3 V. A.C.

U.453 Time Base and C.R.O. (Contd.)

High Tension	To earth {	+300 V. D.C.
		-640 V. D.C.
Plate V_2 to earth		260 V. D.C.
Cathode V_2 to earth		70 V. "
Plate V_3 " "		170 V. "
" V_4 " "		110 V. "
" V_5 " "		82 V. "
Cathode V_6 to H.T. neg.	{ Comp.	280 V. "
	{ Exp.	260 V. "
Screen V_6 to H.T. neg.	{ Comp.	340 V. "
	{ Exp.	330 V. "
Bridge voltage	{ Comp.	180 V. "
	{ Exp.	650 V. "
Volts across C_{12}	{ Comp.	290 V. "
	{ Exp.	270 V. "
Cathodes V_7, V_8 to H.T. neg.	{ Comp.	360 V. "
	{ Exp.	375 V. "
Screens V_7, V_8 to H.T. neg.		540 V. "
Plate V_9 to earth		210 V. "
C.R.O. High Tension		1750 V. "

Front Panel Meter.

C.R.O. 5 KV Position	.32 mA. "
T.B. 1 KV Position	.88 mA. "

U.556 Receiver.

High Tension	350 V. D.C.
Filaments	6.7 V. A.C.

Front Panel Meter Readings:

Meter Anodes:	RF. 1	.51 mA.
	RF. 2	.34 mA.
	MIX	.47 mA.

U.556 Receiver (Contd.).

Osc.	.52 mA.
IF.1	.09 "
IF.2	.04 "
IF.3	.04 "
IF.4	.70 "
Vid.	.79 "
B +	.59 "
Osc. Grid	.96 "

F. U.556 - RECEIVER (MODIFIED TYPE A1-A1-U1).General Specifications:Sensitivity: - 92 db. below 1/10 volt (signal equals noise).Band Width: - $\pm$ 0.14 Mc/s (3 db. down).Tuning Range: - 190 - 210 Mc/s.Power Supply: - 300 V. at 60 mA (Max) H.T. Supply
6.3 to 6.8 V. at 4.5 A. Heater Supply.I.F. Frequency: - 30 Mc/s.Osc. Frequency: - 160 - 180 Mc/s.Drawings:

C.1694 Circuit Diagram

D.1695 Circuit Code

Tube Complement:

2 - 954; 2 - 955; 4 - 6AC7; 2 - 6H6; 1 - 807.

Chassis Voltages. (Tolerance $\pm$ 10%)

N.B. These readings were taken under the following conditions:

- (a) Meter Resistance 1000 Ohms/volt.
- (b) Both Pre-Set and Main Gain Controls at "max" i.e. minimum cathode bias on controlled stages.
- (c) High Tension Supply Volts - 300 V. D.C.
- (d) Heater Supply - 6.4 V. A.C.

954 R.F.L. Anode - 300 V.
 Screen - 80 V.
 Cathode - 1.5 V.

955 Osc. Anode - 180 V.
 Grid Current - 0.8 mA.

<u>954 R.F.2.</u>	Anode	300 V.
	Screen	80 V.
	Cathode	1.7 V.
<u>955 Mixer.</u>	Anode	300 V.
	Cathode	10 V.
<u>6AC7's.</u>	Anodes	300 V.
<u>I.F.'s 1,2 & 3.</u>	Screens	150 V.
	Cathodes	2.5 V. (30 V. with both gain controls at Min.)
<u>6AC7 I.F.4.</u>	Anode	300 V.
	Screen	150 V.
	Cathode	2.5 V.
<u>807 Video Amp.</u>	Anode	180 V.
	Screen	200 V.
	Cathode	28 V.

Monitoring Meter Readings. (Both gain controls at Maximum).

<u>Meter Switch Pos.</u>	<u>Anode</u>	<u>Reading</u>
	(RF1	0.35
	RF2	0.35
	MIX	0.40
	OSC.	0.60
	IF1	0.45
ANODES	IF2	0.40
	IF3	0.44
	IF4	0.54
	Video	0.74
	(H.T.	0.5
OSC. GRID	-----	0.8

Noise Reading.

{ Meter on "Det" & Aerial Off } = 0.5
{ Gain Control at Max. }

ALIGNMENT.

1. I.F.

(Leave interstage screens on). Apply 30 Mc/s. signal to grid of I.F.1 and align all succeeding trimmers to 30 Mc/s. After alignment, the input signal required to give a diode current of 0.4 mA. should not exceed 70 db. below 1/10 volt. This figure refers to actual reading on A.W.A. Signal Generator 30 Mc/s. type with high impedance load (such as 30 Mc/s. tuned circuit) across the output of the cable.

2. Oscillator Frequency.

Check frequency which should be 160 to 180 Mc/s. (Signal frequency 190 - 210 Mc/s.). If out of adjustment, compress or expand oscillator tuning coil until desired range is covered.

3. Oscillator Coupling to Mixer.

Adjust coupling coil until mixer anode current shows a 20% - 30% increase over its normal quiescent value (i.e. with oscillator off).

4. Apply 200 Mc/s. Signal to Aerial Terminal and align aerial, R.F. 1, R.F.2 and anode tuned circuit of mixer for maximum output. When carefully aligned, the input required to double the noise reading should not exceed 92 db. below 1/10 volt.

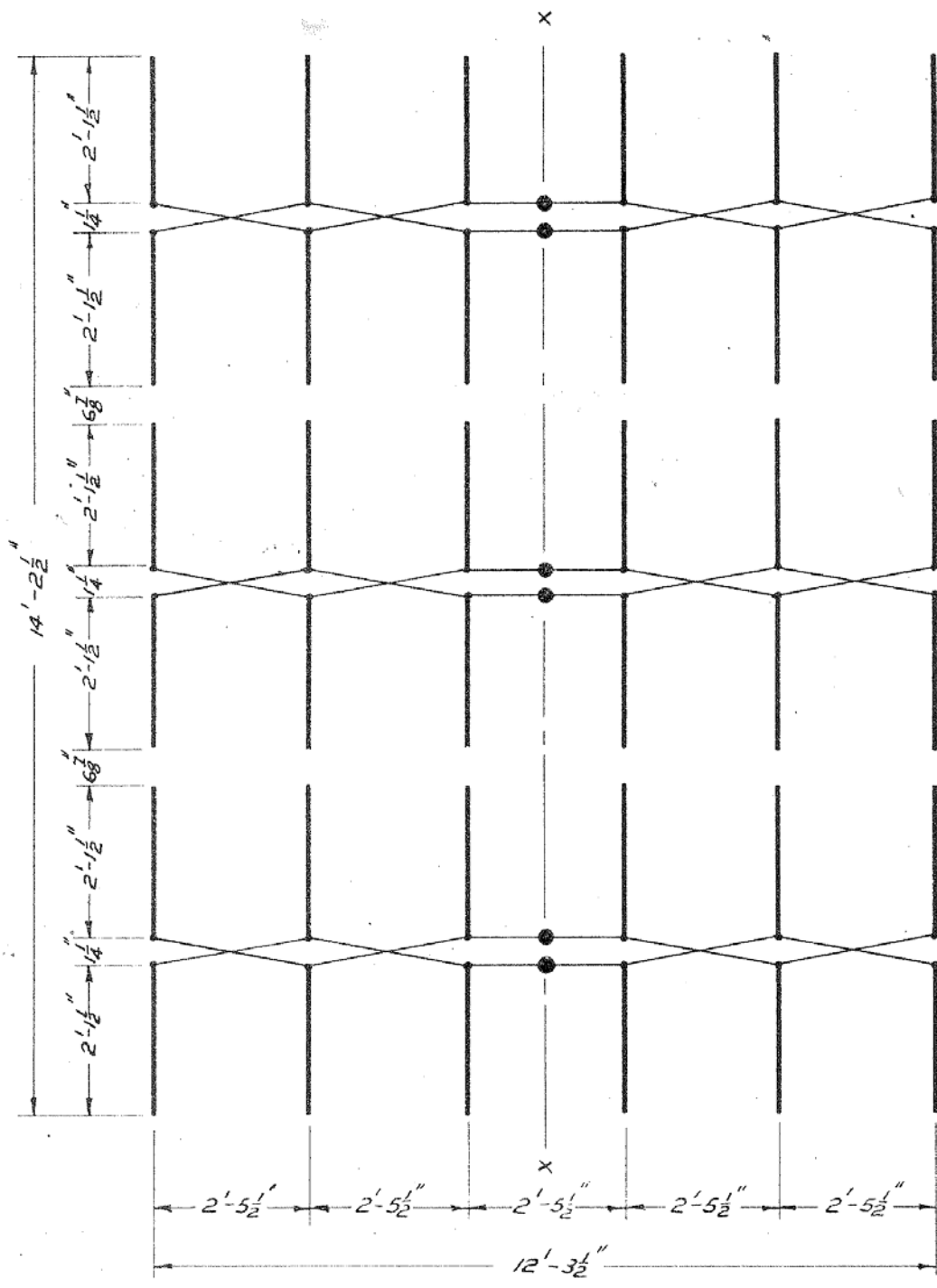
5. Check R.F. tuning range which should be 190 - 210 Mc/s.

If necessary, adjust aerial, and R.F. coils, to obtain this range.

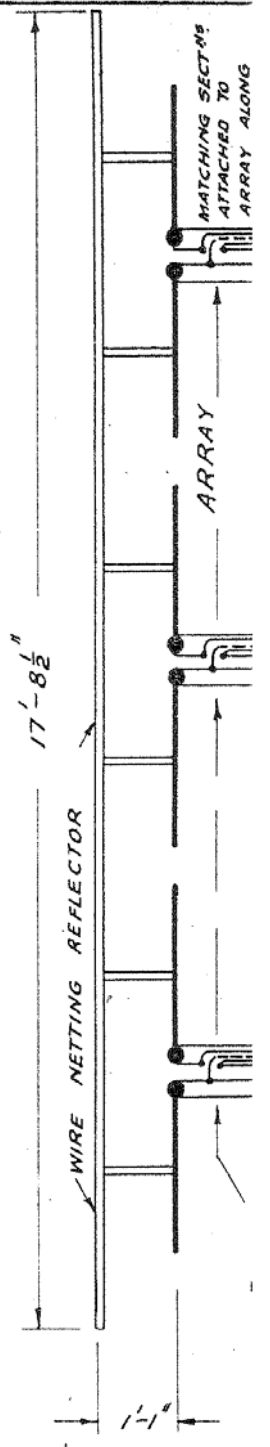
In the event of trouble in the I.F. stages, the following 30 Mc/s. inputs are given as a help to diagnose the faulty stage.

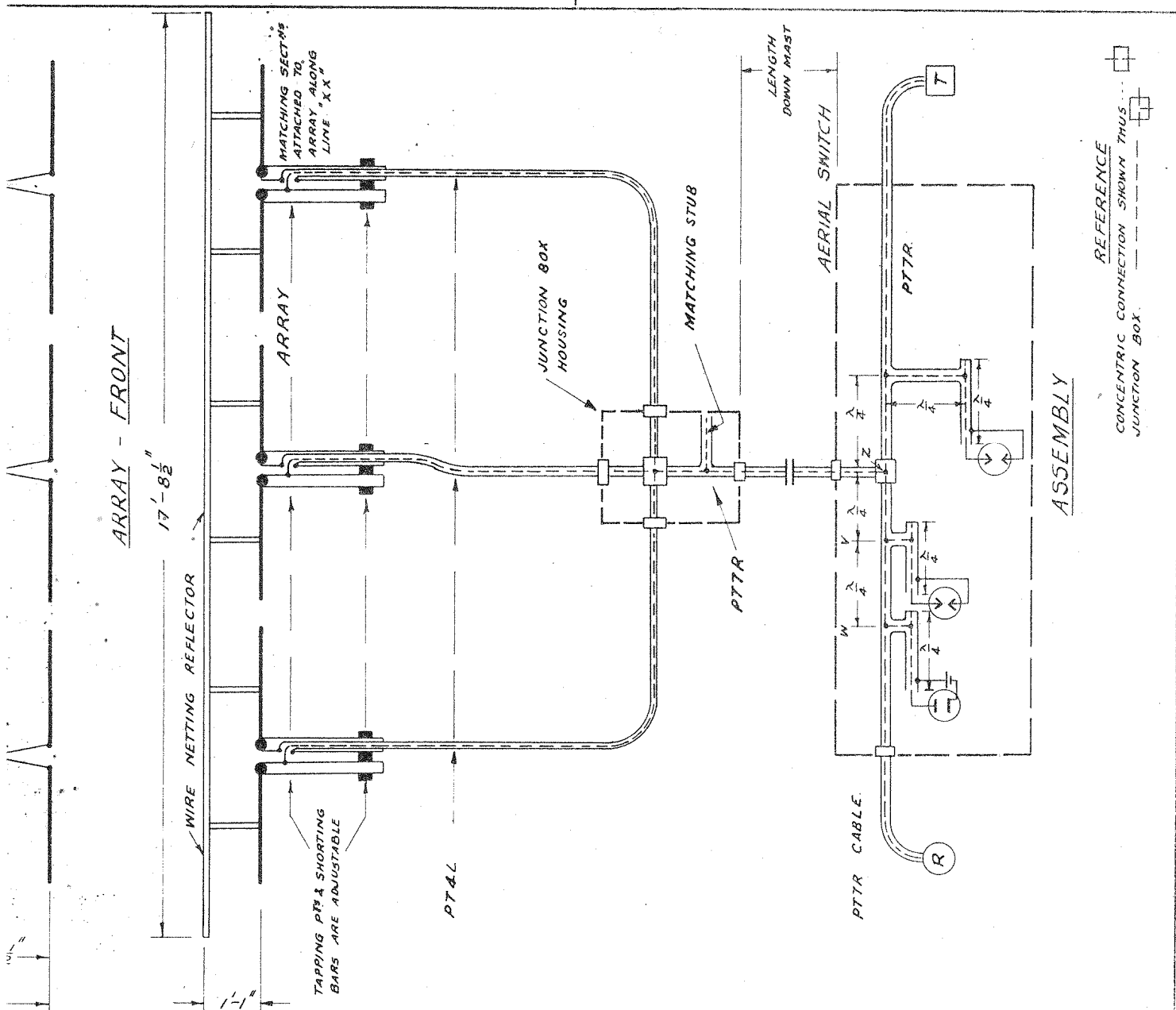
<u>Input to</u>	<u>Diode Reading</u>
I.F.4	1/10 volt
I.F.3	24.5 db.
I.F.2	47 db.
I.F.1	70 db.

Approx. gain per stage - 22 db.



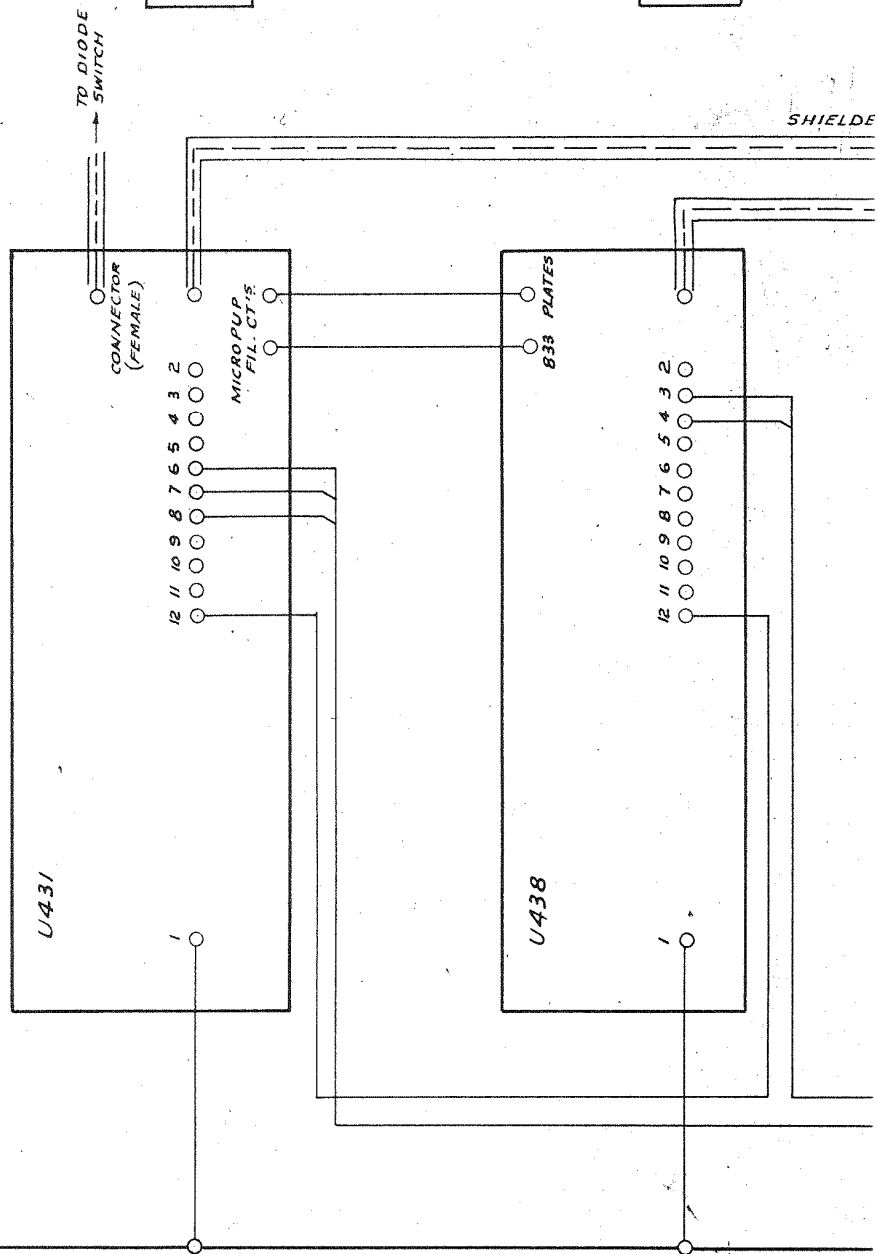
ARRAY - FRONT





				R. P. - C. S. I. R.			
				AERIAL SYSTEM FOR J23			
				SCHEMATIC			
1		31-12-41		SCALE		NOT TO SCALE	
NO.		DATE		PASSED		DRAWN	
				DATE: 1/1/42		TRACED	
				CHECKED		9/1	
ISSUES				D 1462			

EARTH BUS-BAR



11	9	7	5	3	1
12	10	8	6	4	2

11	9	7	5	3	1
12	10	8	6	4	2

5
WA small
ale
4 35/- 012
ck Wire.

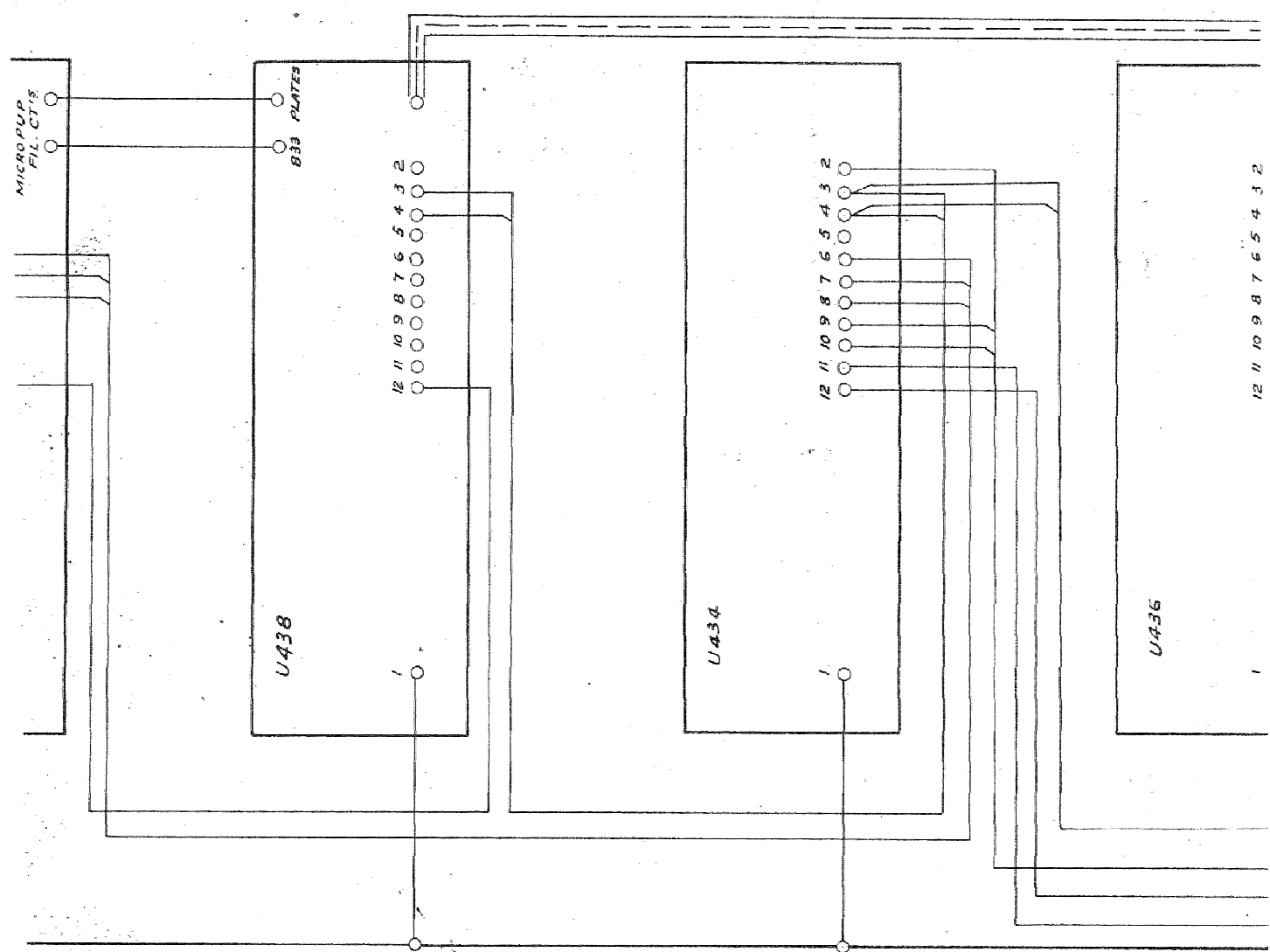
12	10	8	6	4
----	----	---	---	---

11	9	7	5	3
12	10	8	6	4

11	9	7	5	3
12	10	8	6	4

11	9	7	5	3
----	---	---	---	---

SHIELDED IGNITION CABLE



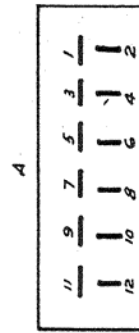
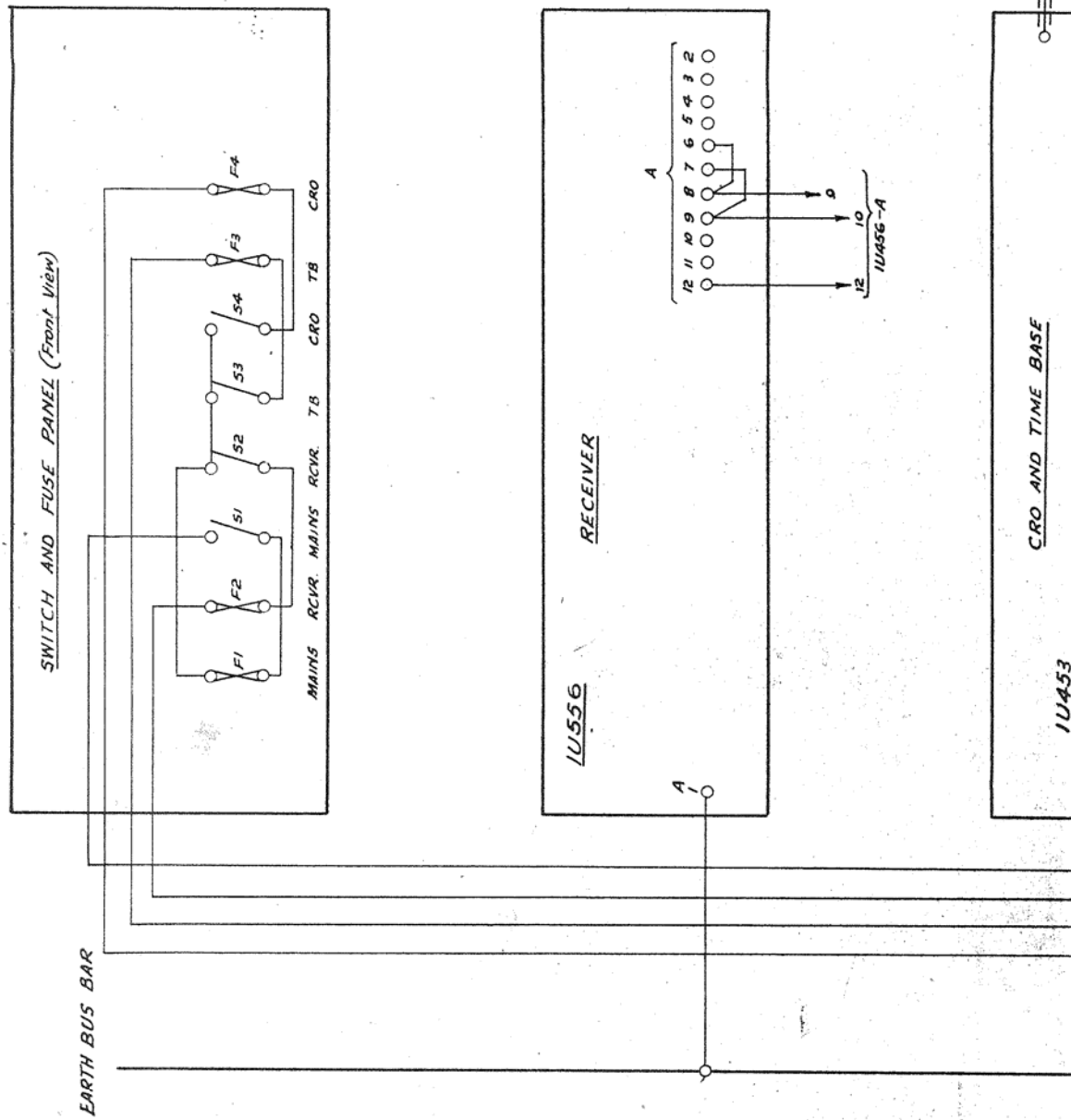
NOTES

All Plugs AWA small
12 pin Female
Wire up with 35/-012
Glozed Block Wire

NO.	DATE	APPROVED

2TES
 ing at back of
 12 pin sockets
 m sockets all pins
 in circuit

CODE
 Black glaze cable
 arwise specified.
 shielded Cab type
 enotube
 Black glaze.
 dia.



NOTES

Views looking at back of large A.W.A. 12 pin sockets
Remove from sockets all pins not wired in circuit

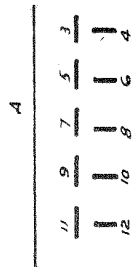
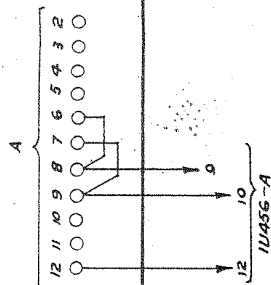
WIRING CODE

Use 35/012 Black glaze cable unless otherwise specified.
L. 3 Core shielded Cab type plus Tenatube
M. 25/012 Black glaze, large dia.

MAINS RCVR MAINS RCVR TB CRO TB CRO

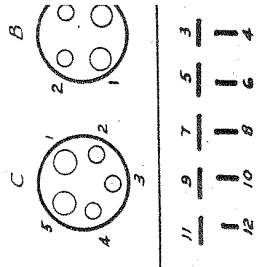
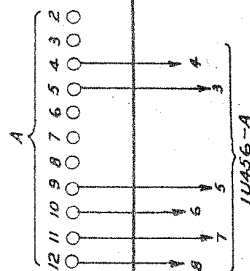
1U556

RECEIVER

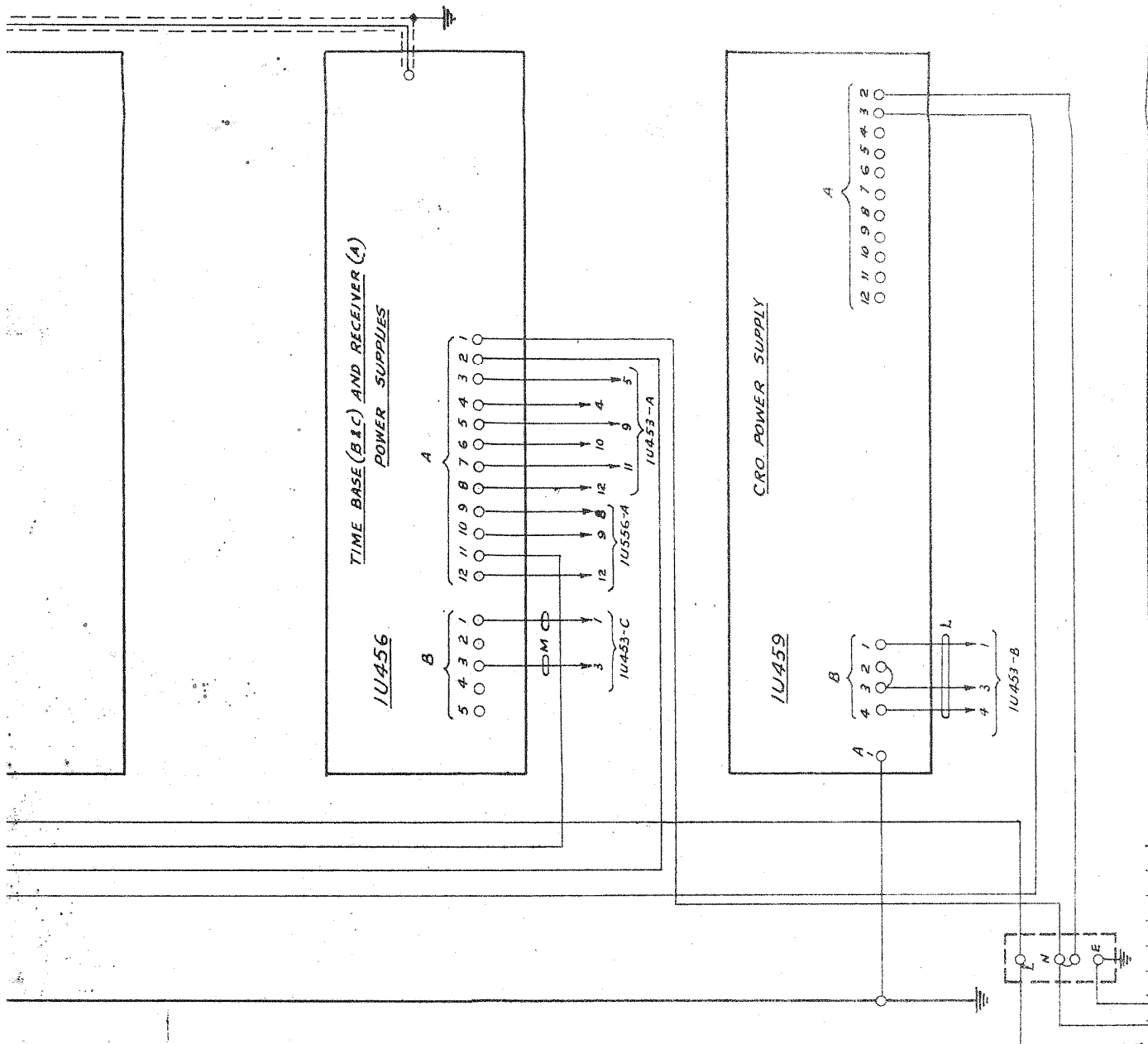
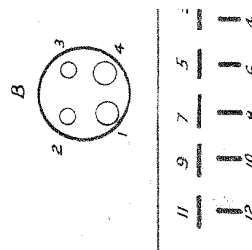
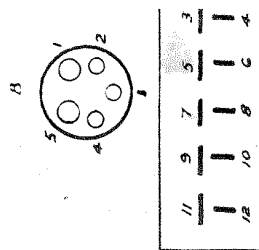


CRO AND TIME BASE

1U453



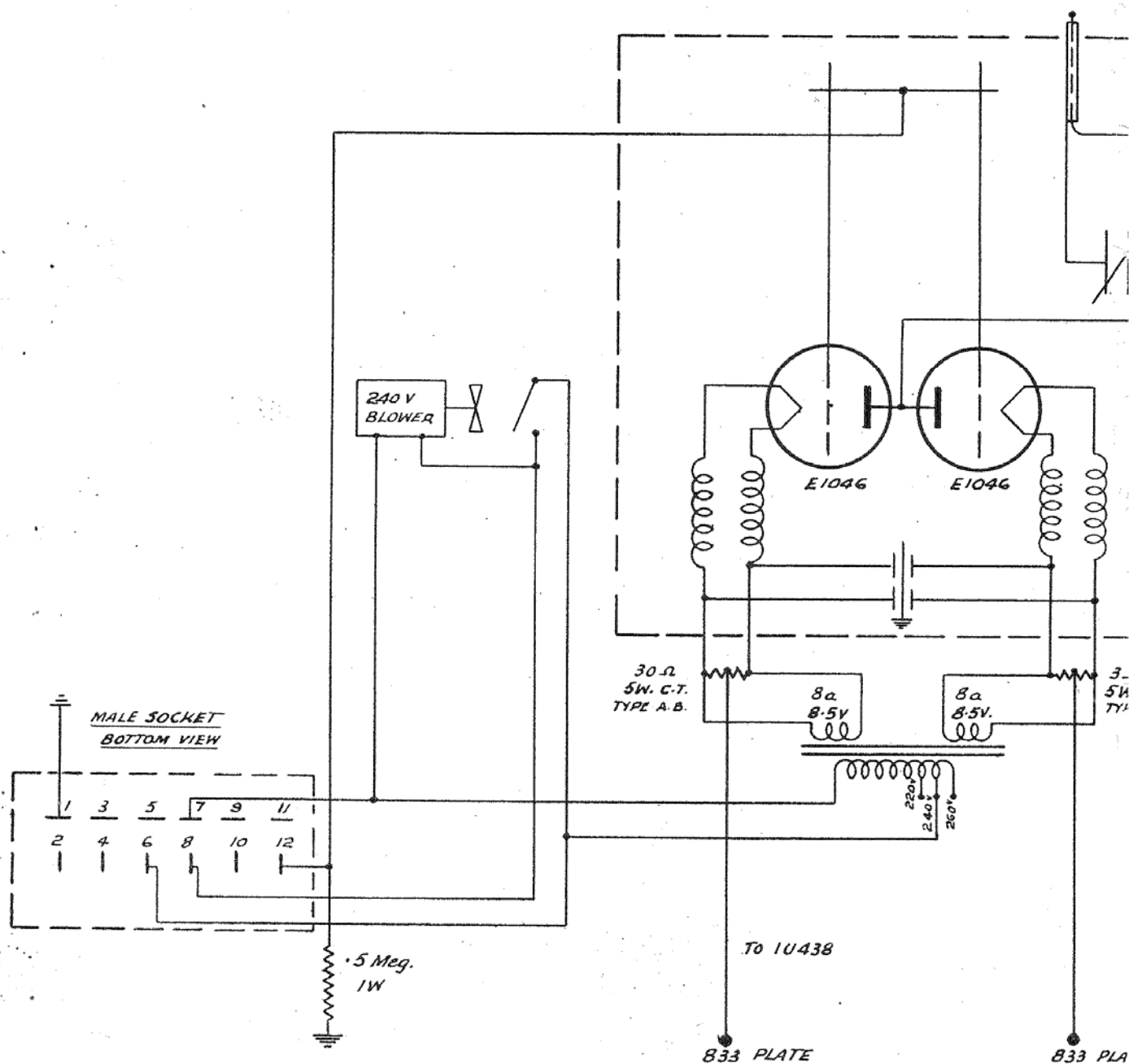
NEG. PULSE TO MODULATOR



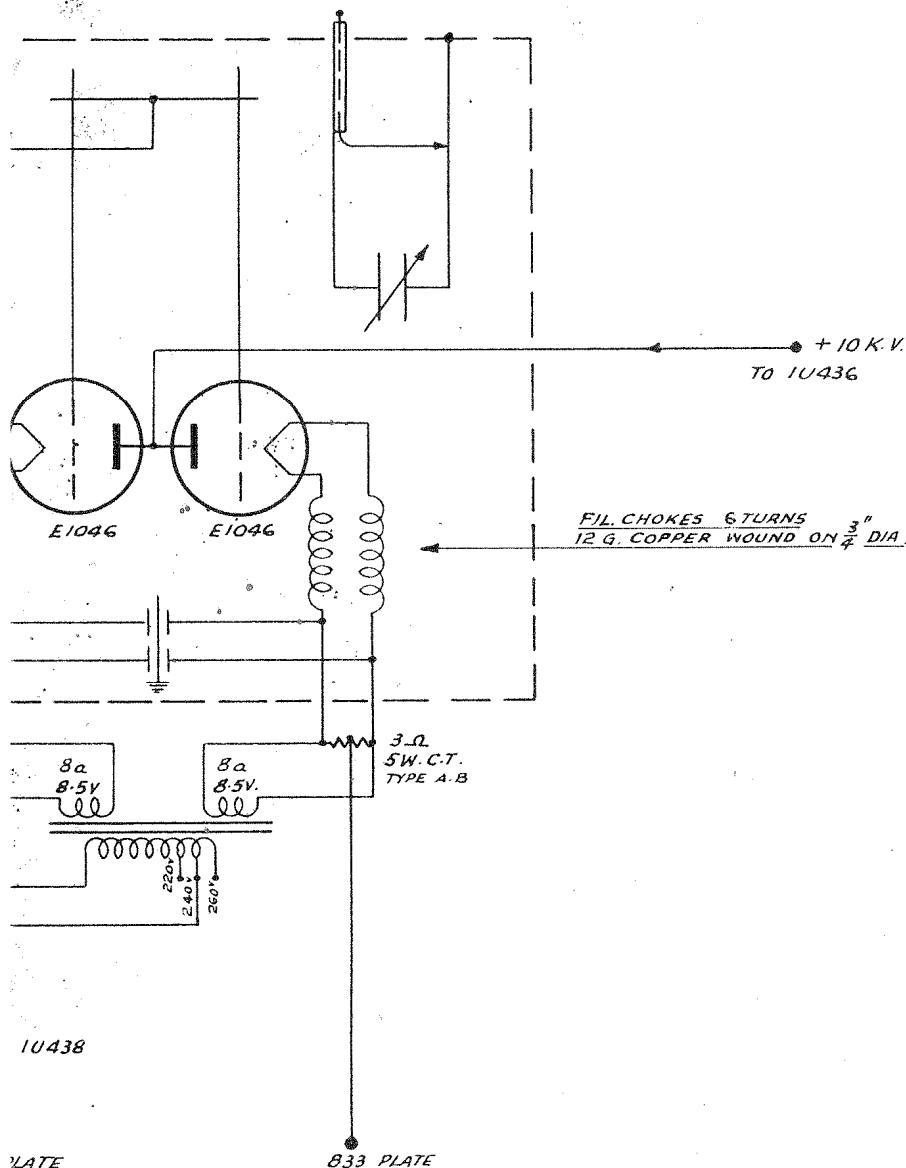
ITEM		DESCRIPTION		ORG. NO.	REQ.	MATERIAL
R.P. — C.S.I.R.						
1K69				Receiver		
WIRING DIAGRAM				Cubicle		
SCALE						
PASSED		DRAWN		D.H.H.		
T.B.A.		TRACED				
CHECKED		M.A.U.				
NO.	DATE	APPROVED	NOTES			
1	25-3-42	8/13				

C

2245



TO DIODE SWITCH
CHASSIS CONN.

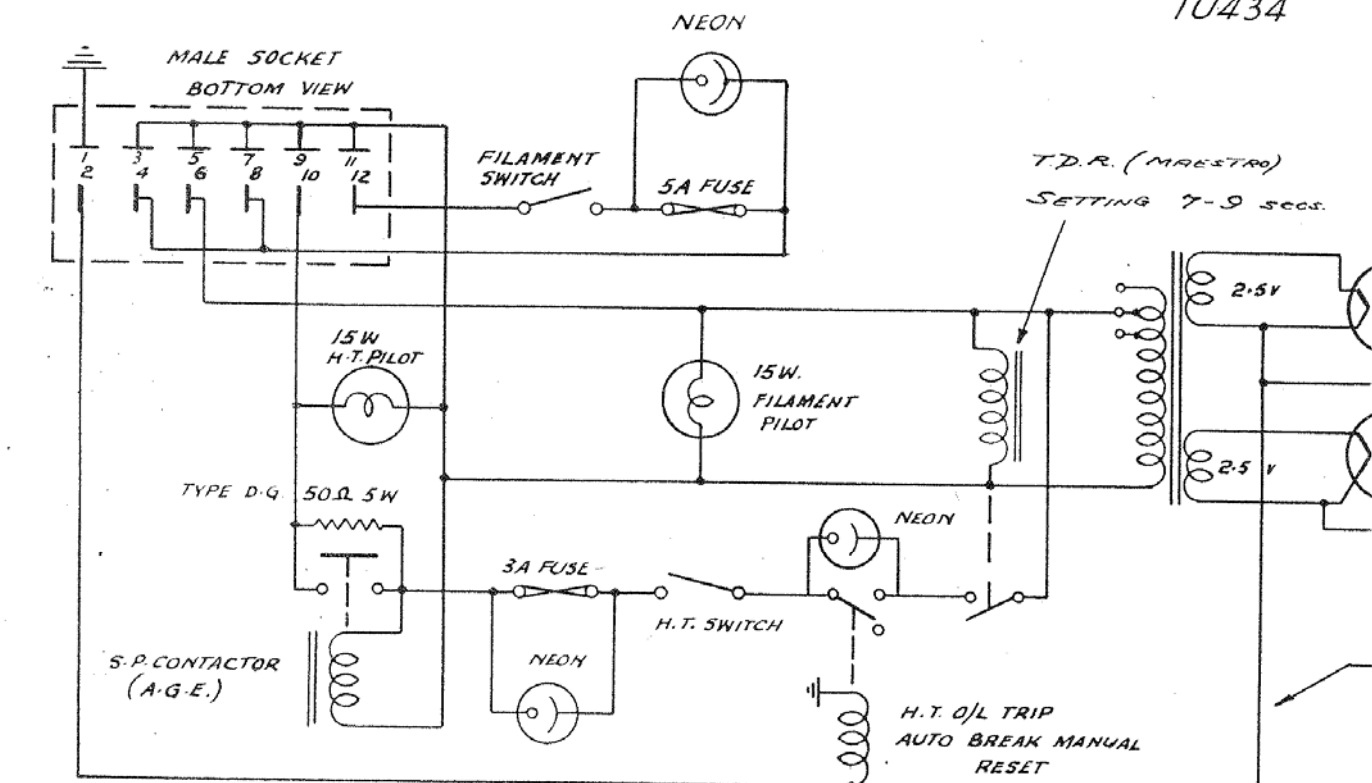


1U438

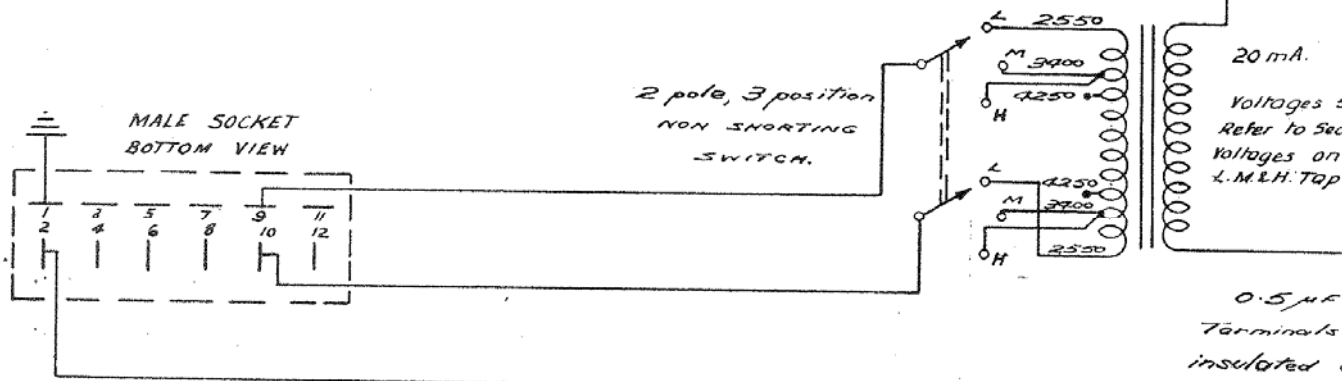
DATE

				R. P. - C. S. I. R.			
				1U431 Transmitter SCHEMATIC			
1		24-3-42		SCALE			
NO.		DATE		PASSED		DRAWN T.B.A.	
		APPROVED		T.B.A.		TRACED	
ISSUES				DATE 27-3-42		CHECKED A.J.H.	
						D 2211	

1U434



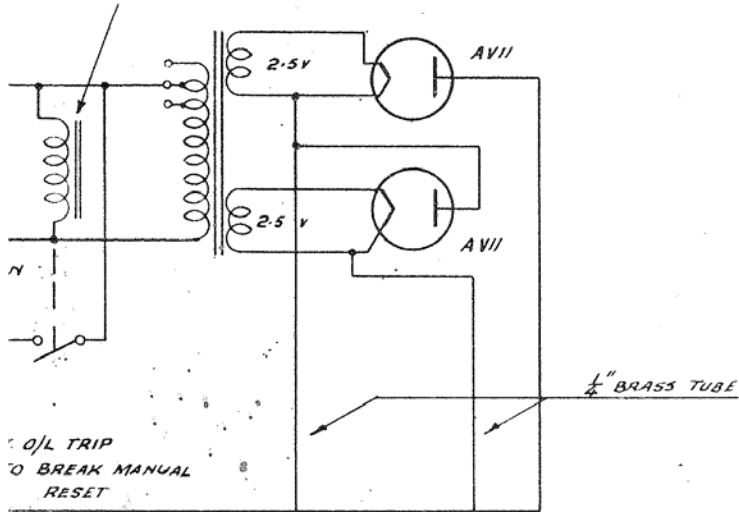
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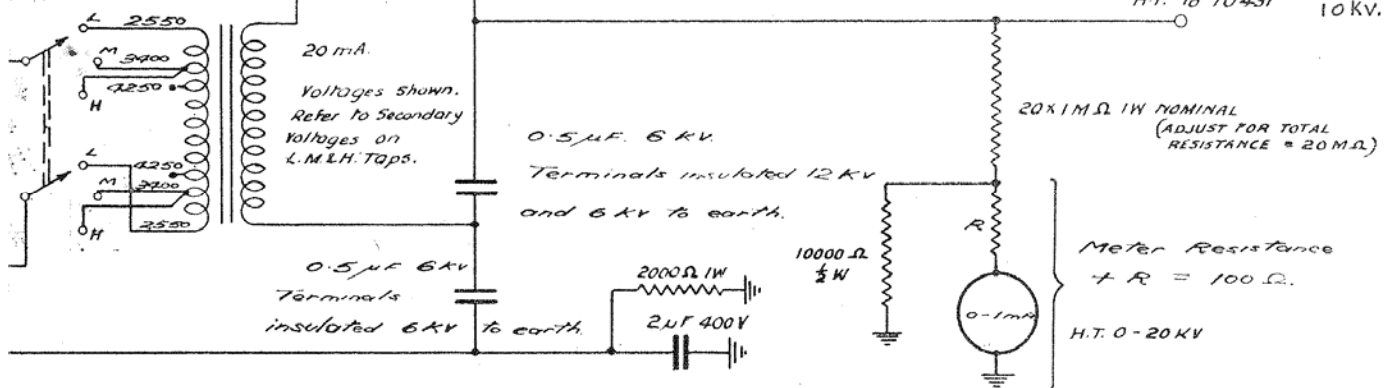
1	2
NO.	

1U434

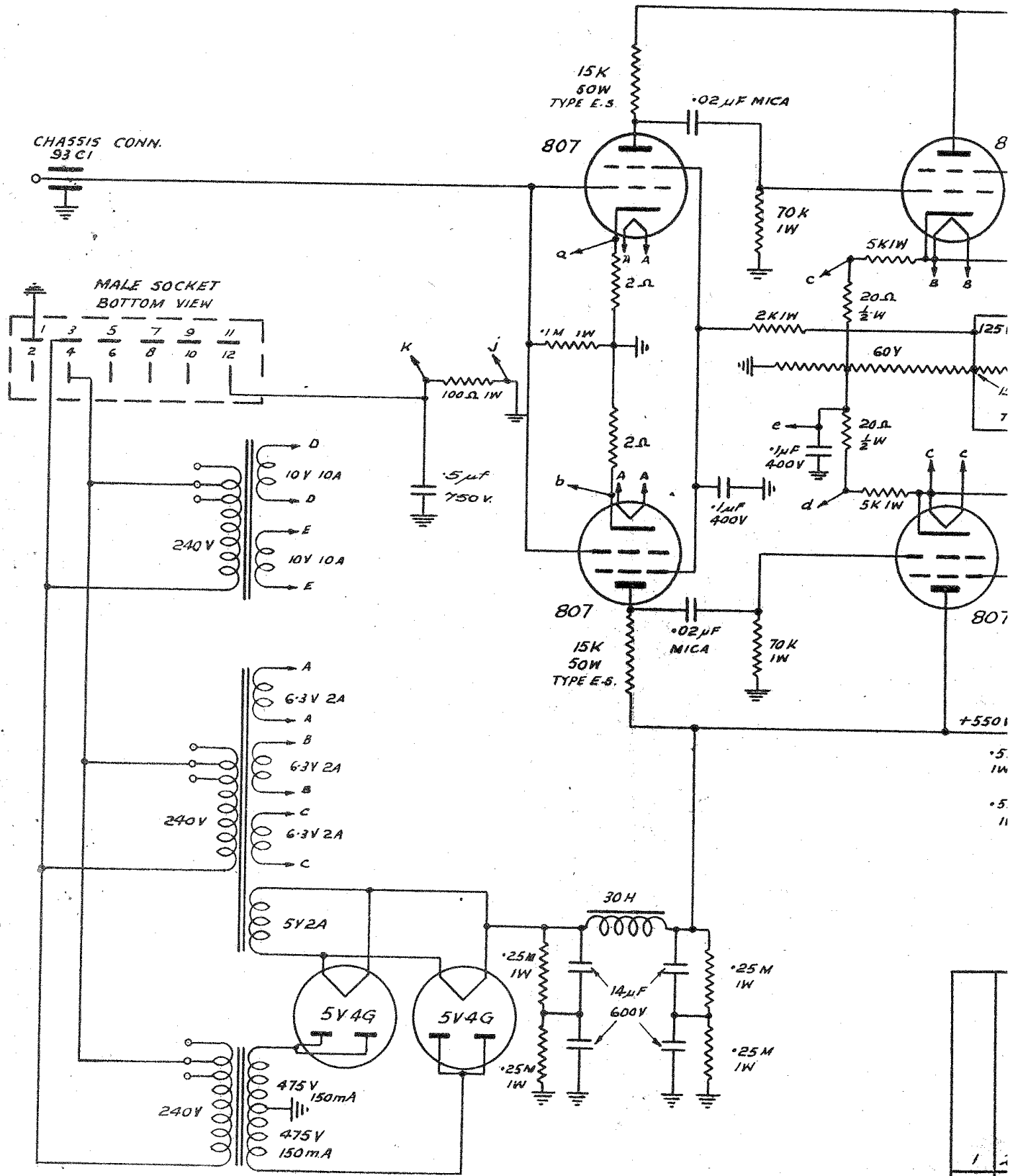
T.D.R. (MAESTRO)
SETTING 7-9 SECS.

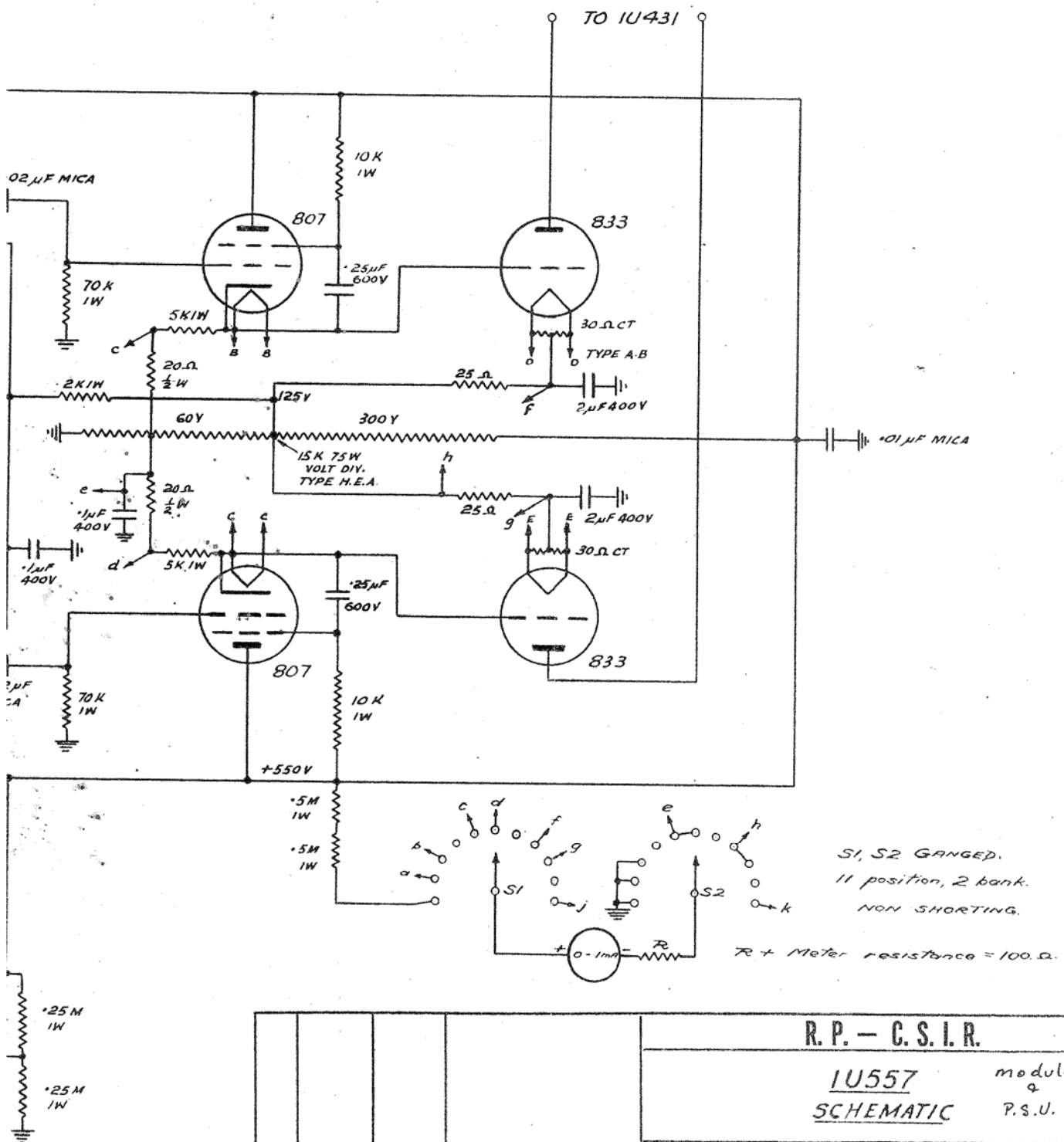


1U436

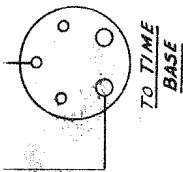


				R. P. - C. S. I. R.			
				1U434-1U436 Transmitter SCHEMATIC Power Supply			
				SCALE			
PASSED		DRAWN		T.B.A.		D 2210	
T.B.A.		TRACED					
DATE: 27-3-9		CHECKED		A.J.H.			
ISSUES							





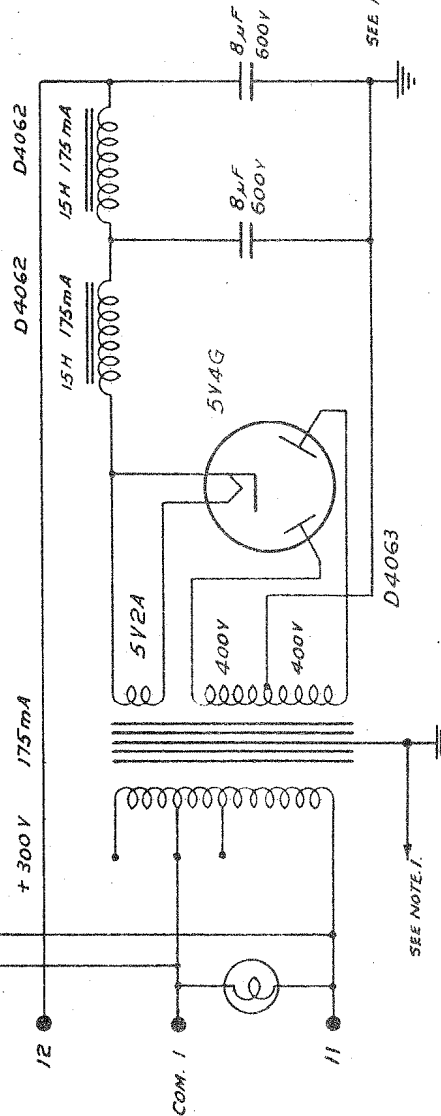
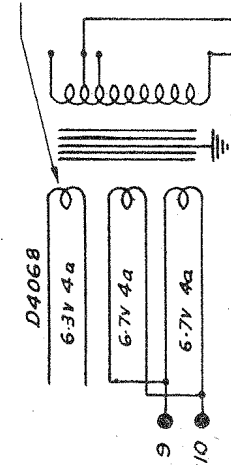
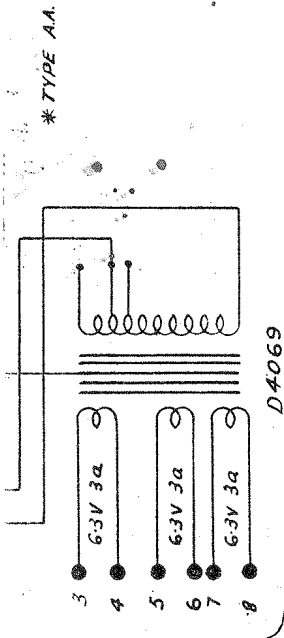
				R. P. - C. S. I. R.			
				1U557 modulator P.S.U.			
				SCHEMATIC			
NO.		DATE		APPROVED		NOTES	
1		28-3-42		R.P.			
ISSUES				SCALE			
PASSED		DRAWN		T.B.A.			
T.B.A.		TRACED					
DATE: 27-2-42		CHECKED		A.J.A.			
				D 2209			



NOTES
1. Earth attached to case of plug.

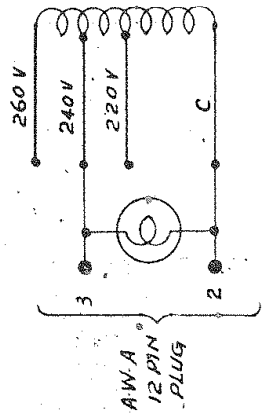
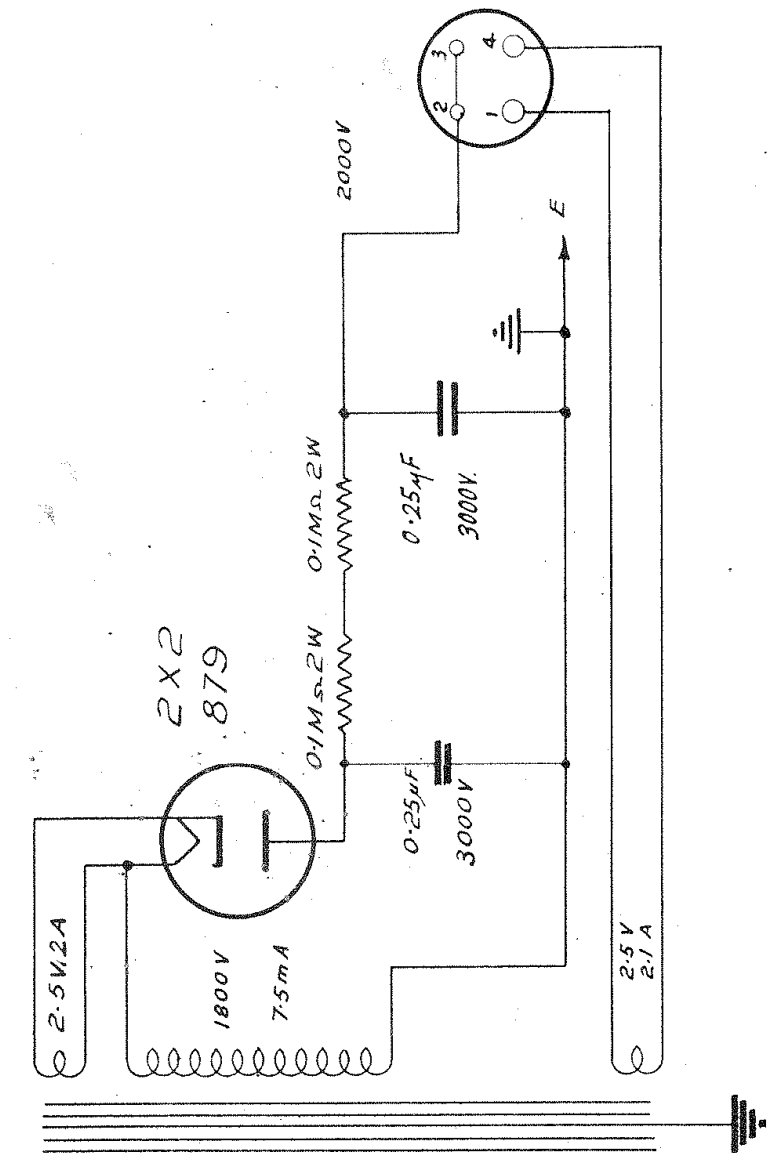
RECEIVER POWER SUPPLY

LOW VOLTAGE INSULATION ONLY



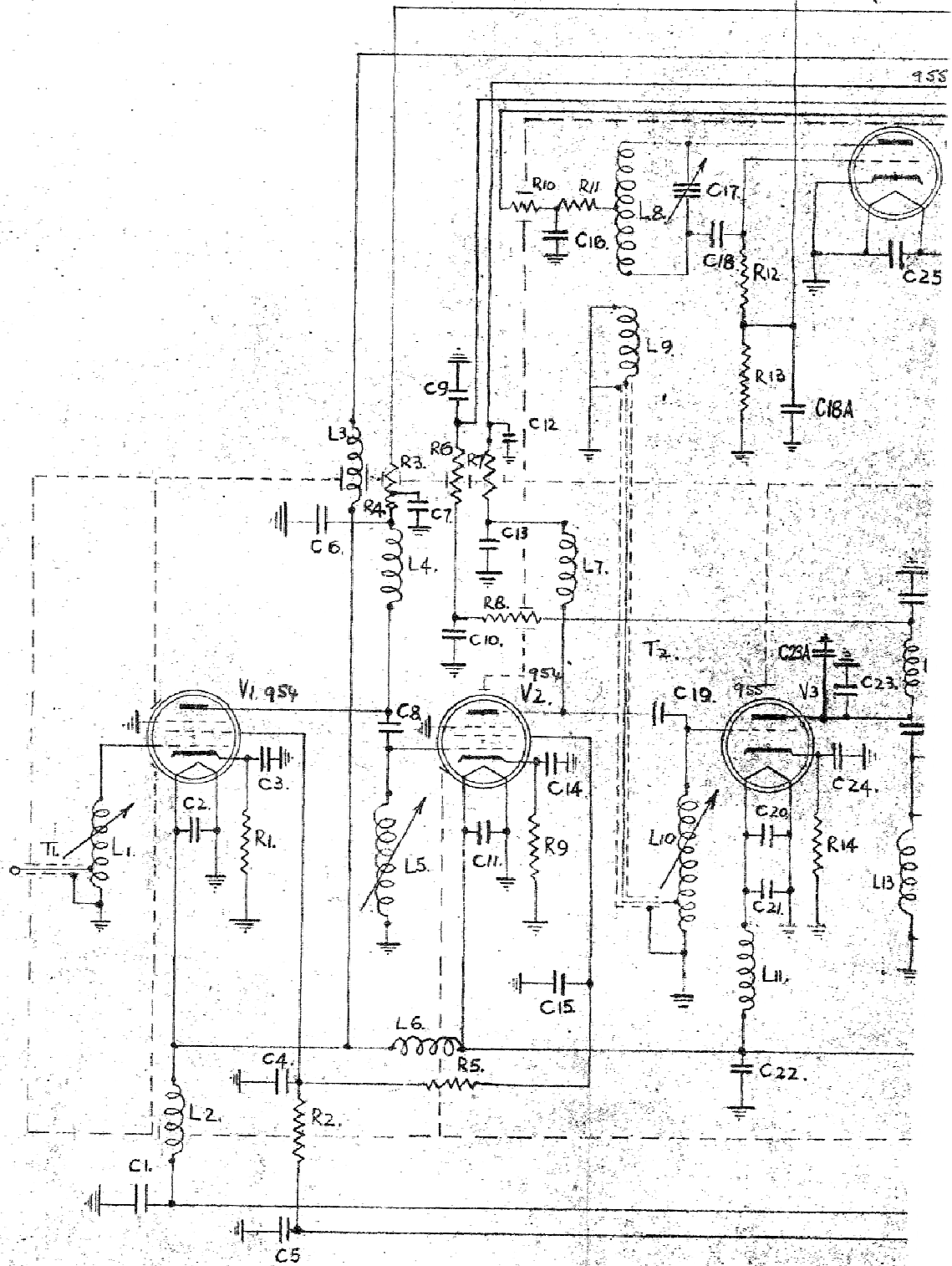
			R. P. - C. S. I. R.		
			1U456 SCHEMATIC		
			Time Base & Receiver P.S.U.		
			SCALE		
			PASSED		
			DRAWN		
			T.B.A.		
			DATE 27-3-42		
			CHECKED		
			A.J.H.		
			D		
			2213		

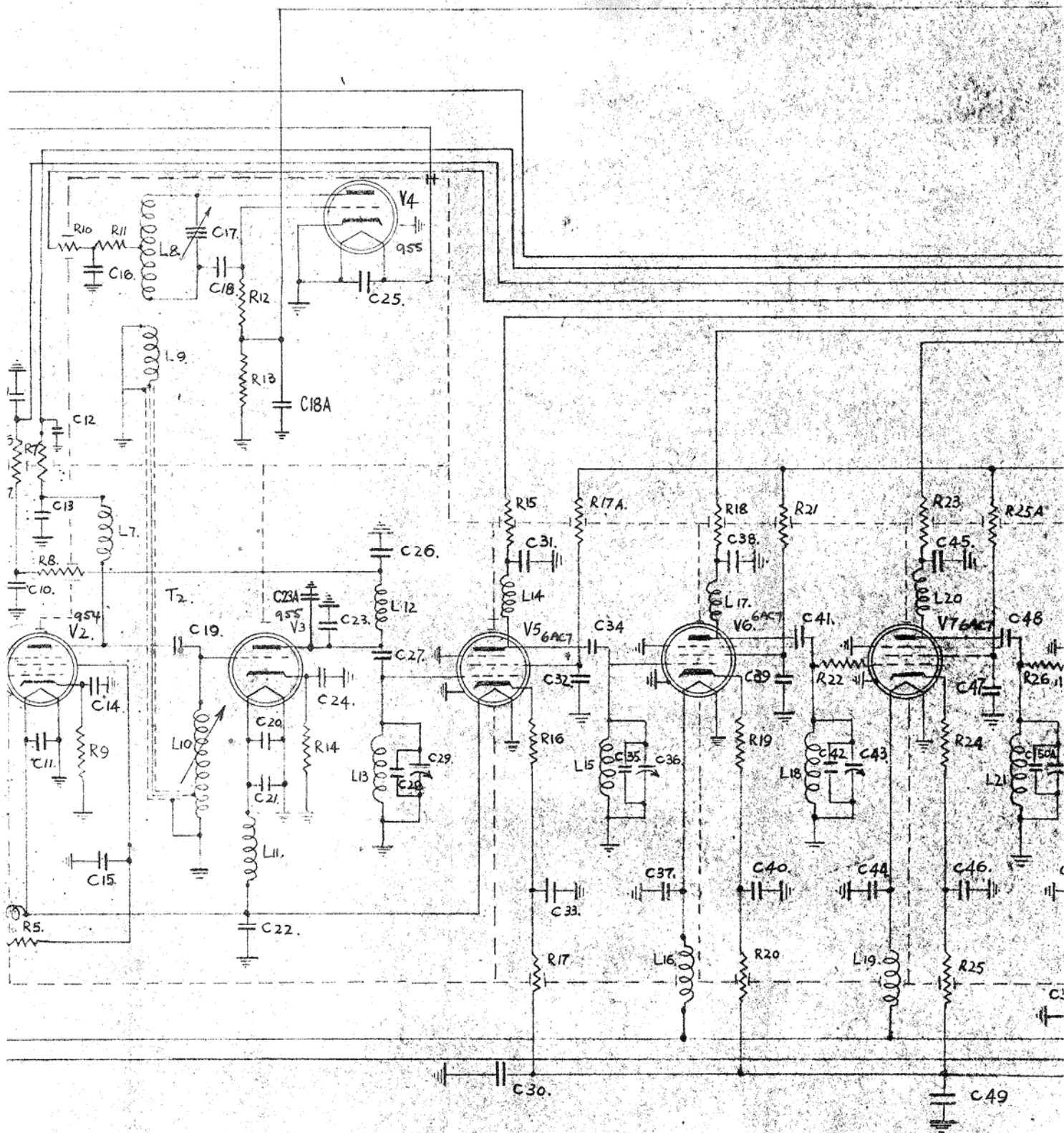
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NO.	DATE	APPROVED	NOTES
ISSUES			

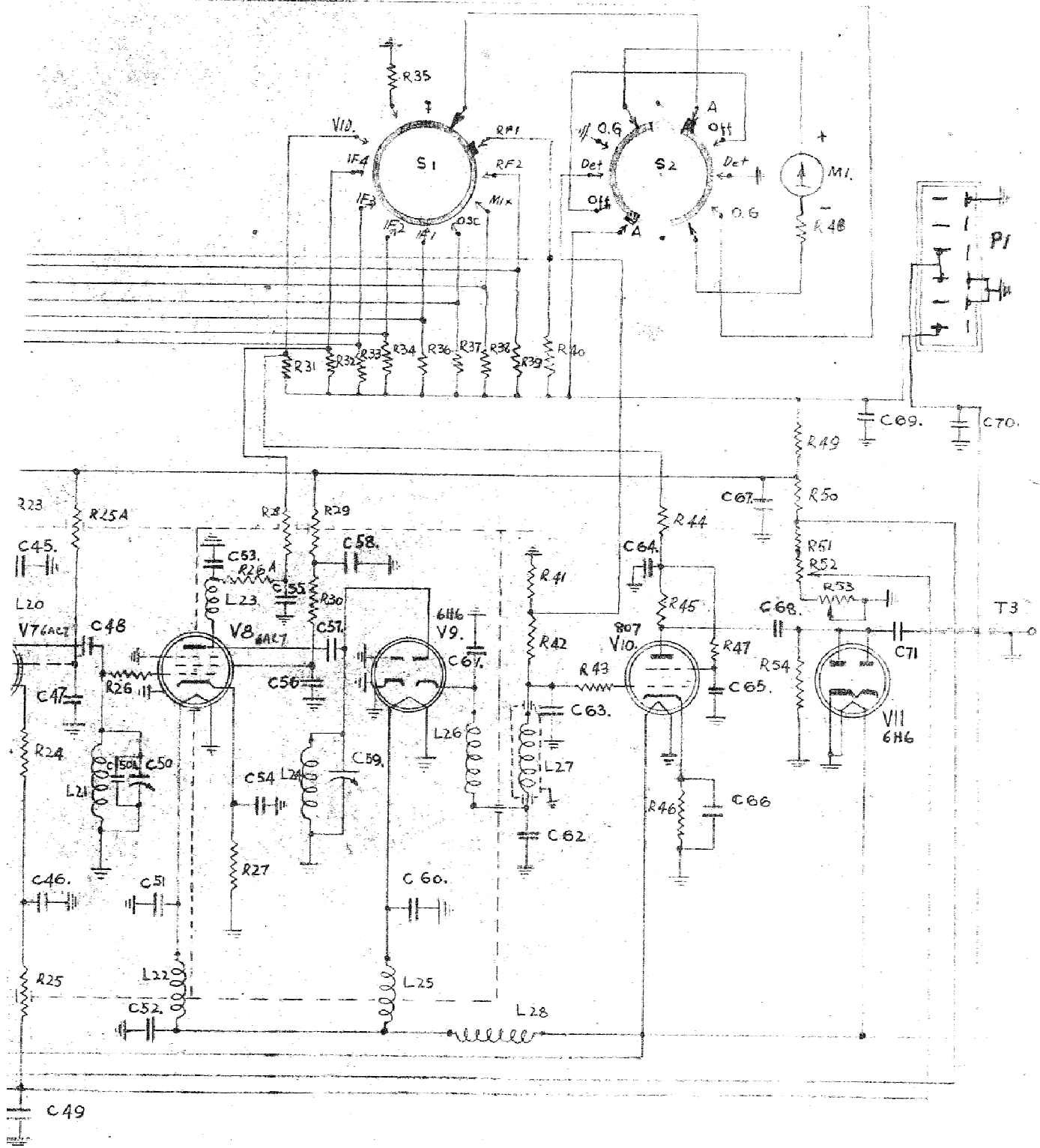


				R. P. - C. S. I. R.		
				U 510 SCHEMATIC CIRCUIT.		
NO.		DATE	APPROVED	NOTES	SCALE	PASSED
1		30-1-42	H/B			30-1-42
				ISSUES	DRAWN	CHECKED
					1600	

CRO
Power Supply







ITEM		DESCRIPTION		ORG. NO.	REQ.	MATERIAL
R. P. — C. S. I. R.						
RECEIVER U556						
TYPE AI-AI-UI MODIFIED						
SCHEMATIC						
SCALE						
PASSED		DRAWN				
DATE		TRACED				
DATE		CHECKED				
30.3.42 12-2-42		C18A, C23A, C71 ADDED; P1 VARIED.				
DATE		APPROVED		NOTES		
ISSUES						
C 1694						

C

1694

COMPONENT PARTS LIST - U556

INDUCTANCES		RESISTORS		CONDENSERS	
Code No.		Code No.		Code No.	
L 1	Inductance tuner, aerial (4 turns)	R 1	500 ohms $\frac{1}{2}$ W. Ducon Carbon	C 1	1000 μ F 400 V. Wkg. Midget Mica
L 2	Heater choke type A	R 2	500 " " " "	C 2	100 " " " "
L 3	Heater choke type B	R 3	1000 " " " "	C 3	20 " " " "
L 4	200 MC 1/4 wave choke	R 4	1000 " " " "	C 4	100 " " " "
L 5	Inductance tuner, R.F. 1. (2 $\frac{1}{2}$ turns)	R 5	500 " " " "	C 5	1000 " " " "
L 6	Heater choke type A	R 6	1000 " " " "	C 6	100 " " " "
L 7	200 MC 1/4 wave choke	R 7	1000 " " " "	C 7	100 " " " "
L 8	Oscillator coil (5 turns)	R 8	500 " " " "	C 8	50 " " " "
L 9	Oscillator coupling coil ($\frac{1}{2}$ turn)	R 9	1000 " " " "	C 9	1000 " " " "
L 10	Inductance tuner R.F. 2 (2 $\frac{1}{2}$ turns)	R 10	1000 " " " "	C 10	1000 " " " "
L 11	Heater choke type B	R 11	20,000 ohms 2 W. I.R.C.	C 11	100 " " " "
L 12	30 MC choke	R 12	25,000 " $\frac{1}{2}$ W. Ducon Carbon	C 12	100 " " " "
L 13	I.F. coil (14 turns) 22 swg enamel on $\frac{1}{2}$ W. Form	R 13	100 ohms $\frac{1}{2}$ W. Ducon Carbon	C 13	100 " " " "
L 14	30 MC choke	R 14	2000 ohms $\frac{1}{2}$ W. Ducon Carbon	C 14	50 " " " "
L 15	I.F. coil (as L13)	R 15	500 ohms " " " "	C 15	100 " " " "
L 16	Heater choke type B	R 16	30 ohms $\frac{1}{2}$ W. Ducon Carbon Non-inductive	C 16	100 " " " "
L 17	30 MC choke	R 17	300 ohms $\frac{1}{2}$ W. Ducon Carbon	C 17	Split Stator Variable Condenser
L 18	I.F. coil (as L 13)	R 17A	500 " " " "	C 18	20 μ F 400 V. Wkg. Midget Mica
L 19	Heater choke type B	R 18	500 " " " "	C 19	50 " " " "
L 20	30 MC choke	R 19	30 ohms $\frac{1}{2}$ W. Ducon Carbon Non-inductive	C 20	100 " " " "
L 21	I.F. coil (as L13)	R 20	300 ohms $\frac{1}{2}$ W. Ducon Carbon	C 21	1000 μ F " " " "
L 22	Heater choke type B	R 21	500 ohms $\frac{1}{2}$ W. Ducon Carbon	C 22	1000 " " " "
L 23	30 MC choke	R 22	20 ohms $\frac{1}{2}$ W. Ducon Carbon	C 23	20 " " " "
L 24	I.F. coil (26 turns) 23 swg enamel on $\frac{1}{2}$ W. Form	R 23	500 ohms $\frac{1}{2}$ W. Ducon Carbon	C 24	100 " " " "
L 25	Heater choke type B	R 24	30 ohms $\frac{1}{2}$ W. Ducon Carbon Non-inductive	C 25	500 " " " "
L 26	30 MC choke	R 25	300 ohms $\frac{1}{2}$ W. Ducon Carbon	C 26	1000 " " " "
L 27	30 MC choke	R 25A	500 ohms $\frac{1}{2}$ W. Ducon Carbon	C 27	100 " " " "
L 28	Heater choke type A	R 26	20 ohms $\frac{1}{2}$ W. Ducon Carbon	C 28	20 " " " "
		R 26A	500 ohms $\frac{1}{2}$ W. Ducon Carbon	C 29	A.W.A. Air trimmer 15 plate
		R 27	300 " " " "	C 30	1000 μ F 400 V. Wkg. Midget Mica
		R 28	500 " " " "	C 31	1000 " " " "
		R 29	500 " " " "	C 32	1000 " " " "
		R 30	500 " " " "	C 33	1000 " " " "
		R 31	500 ohms $\frac{1}{2}$ W. Ducon Carbon (Meter Shunt)	C 34	100 " " " "
		R 32	10 ohms $\frac{1}{2}$ W. Ducon Carbon	C 35	20 " " " "
		R 33	10 " " " "	C 36	A.W.A. Air trimmer. 15 plate
		R 34	10 " " " "	C 37	100 μ F 400 V. Wkg. Midget Mica
		R 35	1/2 Meg.	C 38	1000 " " " "
		R 36	10 ohms " " " "	C 39	1000 " " " "
		R 37	10 " " " "	C 40	1000 " " " "
		R 38	10 " " " "	C 41	100 " " " "
		R 39	20 " " " "	C 42	20 " " " "
		R 40	20 " " " "	C 43	A.W.A. Air trimmer. 15 plate
		R 41	1000 ohms $\frac{1}{2}$ W. Ducon Carbon	C 44	1000 μ F 400 V. Wkg. Midget Mica
		R 42	10,000 ohms $\frac{1}{2}$ W. Ducon Carbon	C 45	1000 " " " "
		R 43	500 ohms $\frac{1}{2}$ W. Ducon Carbon	C 46	1000 " " " "
		R 44	500 ohms 1 W. Ducon Carbon	C 47	1000 " " " "
		R 45	10,000 ohms 8 W. Ducon Carbon	C 48	100 " " " "
		R 46	3000 ohms 2 W. I.R.C.	C 49	100 " " " "
		R 47	50,000 ohms 1 W. Ducon Carbon	C 50	A.W.A. Air trimmer. 15 plate
				C 50A	20 μ F 400 V. Wkg. Midget Mica
				C 51	1000 μ F " " " "
				C 52	1000 " " " "
				C 53	1000 " " " "
				C 54	1000 " " " "

VALVES

- 1st R.F.
- 2nd R.F.
- Mixer
- Oscillator
- 1st I.F.
- 2nd I.F.
- 3rd I.F.
- 4th I.F.
- Detector
- Video Amp.
- D.C. Leveller

954 1st R.F.
 954 2nd R.F.
 955 Mixer
 955 Oscillator
 955 1st I.F.
 955 2nd I.F.
 955 3rd I.F.
 955 4th I.F.
 955 Detector
 955 Video Amp.
 955 D.C. Leveller

R. P. - C. S. I. R.			
CIRCUIT CODE FOR RECEIVER U556			
SCALE			
PASSED	DRAWN		
DATE:	CHECKED		
ISSUES		D 1695	

R 32 10 ohms 1/2 W. Ducon Carbon (Meter Shunt)
 R 33 10 " " " " " "
 R 34 10 " " " " " "
 R 35 10 " " " " " "
 R 36 10 ohms 1/2 Meg.
 R 37 10 " " " " " "
 R 38 10 " " " " " "
 R 39 20 " " " " " "
 R 40 20 " " " " " "
 R 41 1000 ohms 1/2 W. Ducon Carbon
 R 42 10,000 ohms 1/2 W. Ducon Carbon
 R 43 500 ohms 1/2 W. Ducon Carbon
 R 44 500 ohms 1 W. Ducon Carbon
 R 45 10,000 ohms 8 W. Ducon Carbon
 R 46 3000 ohms 2 W. I.R.C.
 R 47 50,000 ohms 1 W. Ducon Carbon
 R 48 100 ohms Meter (Internal Resistance)
 R 49 10,000 ohms 8 W. I.R.C. D.G. Type
 R 50 10,000 ohms 2 W. I.R.C.
 R 51 7000 ohms 2 W. I.R.C.
 R 52 2500 ohms 3 W. Pot.
 R 53 1000 ohms 3 W. Pot.
 R 54 0.1 Meg. 1/4 W. Ducon Carbon

Code No.

M 1 0 - 1.0 M.A. D.C.

TRANSMISSION LINES

Code No.

T 1 80 ohm Lead covered Polythene line
 T 2 80 ohm " " " "

SWITCHES

Code No.

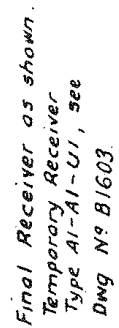
S 1 1 pole 11 position switch. Meter Anodes Switch
 S 2 2 pole 4 position switch. Meter Switch

PLUGS

Code No.

P 1 12 pin power connector

C 36 1000 " " " " " "
 C 39 1000 " " " " " "
 C 40 1000 " " " " " "
 C 41 100 " " " " " "
 C 42 20 " " " " " "
 C 43 A.W.A. Air trimmer. 15 plate
 C 44 1000 μ F 400 V. Wkg. Midget Mica
 C 45 1000 " " " " " "
 C 46 1000 " " " " " "
 C 47 1000 " " " " " "
 C 48 100 " " " " " "
 C 50 A.W.A. Air trimmer. 15 plate
 C 50A 20 μ F 400 V. Wkg. Midget Mica
 C 51 1000 μ F 400 V. Wkg. Midget Mica
 C 52 1000 " " " " " "
 C 53 1000 " " " " " "
 C 54 1000 " " " " " "
 C 55 1000 " " " " " "
 C 56 1000 " " " " " "
 C 57 100 " " " " " "
 C 58 1000 " " " " " "
 C 59 A.W.A. Air trimmer. 15 plate
 C 60 1000 μ F 400 V. Wkg. Midget Mica
 C 61 50 " " " " " "
 C 62 20 " " " " " "
 C 63 20 " " " " " "
 C 64 1000 " " " " " "
 C 65 .5 mf Paper 400 V. working
 C 66 5 mf. " " " " " "
 C 67 1000 μ F 400 V. Wkg. Midget Mica
 C 68 0.5 mf Paper 400 V. Working
 C 69 .5 mf " " " " " "
 C 70 .5 mf " " " " " "
 C 71 .05 mf " " " " " "
 C 18A 100 μ F 400 V. Wkg. Midget Mica
 C 23A 10 μ F " " " " " "



GRID V3

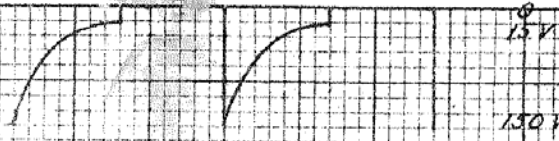
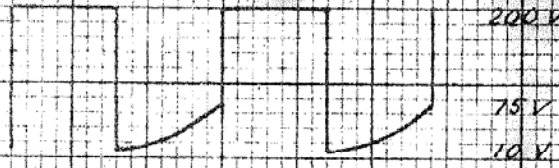


PLATE V3



GRID V2



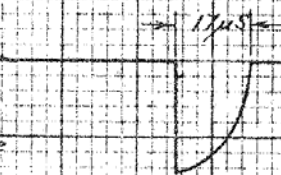
PLATE V2



PLATE V1



PLATE V1
Expanded time scale



J23
File N°C9/4/5
P.D17

Drawn L.P.
checked M.G.
Approved S.P.
Date 21/1/42
DWG N°P1634

GRID V5

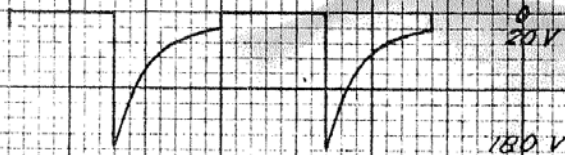


PLATE V5



GRID V4

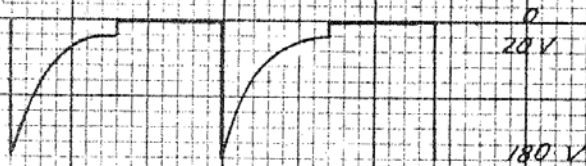
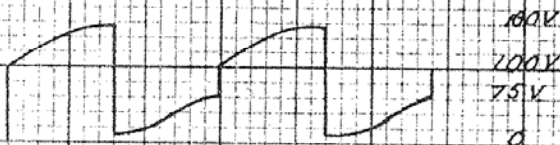


PLATE V4



J23

FILE N° C9/4/5

P.D. 17

DRAWN L.P.

CHECKED M.B.

APPROVED J.P.

DATE 4/1/44

DWG N° 9/635

GRID V6



PLATE V6
CONTRACT

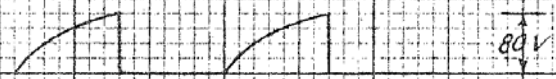


PLATE V6
EXPAND



CATHODE V6

Similar in shape to plate of V6
but about $\frac{1}{4}$ amplitude

J23

FILE NO. C9/4/5
P.D.17

DRAWN L.P.
CHECKED *AMB*
APPROVED *AMB*
DATE 4/14/42
DWG. NO. P-1636

PLATE V7

Potentiometer at zero.
Contract & Expanded
position Similar.

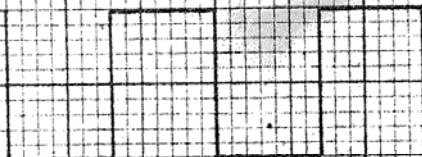


PLATE V8

CONTRACT

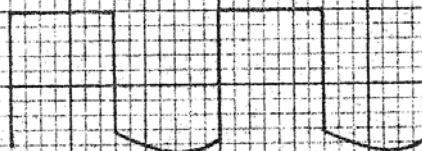
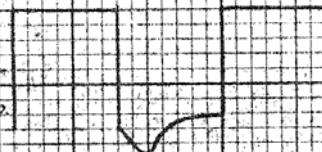


PLATE V8

Potentiometer at zero.
EXPAND



J23

FILE N° C9/4/5

FD17

DRAWN L.P.

CHECKED G.M.B.

APPROVED H.B.

DATE 4/1/62

DWG N° P1637

ADJUSTMENT OF THE A.W. AERIAL ARRAYContents

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1.2. Feeder System	1
1.3. Matching Arrangements	1 - 2
2. <u>IMPEDANCE GEAR</u>	
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2.2.1. Impedance Measurement	4 - 5
3. <u>AERIAL MATCHING PROCEDURE</u>	
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3.2. Matching the Aerial Sections	6 - 8
3.3. Matching to the Main Feeder	8 - 9
3.4. Adjustment of the Array Without Impedance Gear.	9

25th March, 1942.

PART IIADJUSTMENT OF THE A.W. AERIAL ARRAYList of Drawings

<u>Title</u>	<u>Number</u>
Schematic of A.W. Aerial System	D.2254
Schematic of Feeder System	D.2255
Form of Feeder Terminating Resistance Variation	P.2256
Construction of the Impedance Gear	D.2257
Interconnection of Impedance Gear Units	P. 701

CHARTS.

Series	{ R Component of Unknown Impedance	CXS.14 }	} not included
Values	{ X " " " "	CXS.15 }	
Parallel	{ G Component of Unknown Impedance	CXS.16 }	} not included
Values	{ B " " " "	CXS.17 }	

PART IIADJUSTMENT OF THE A.W. AERIAL ARRAY1. DESCRIPTION OF THE AERIAL ARRAY.1.1. Arrangement of Elements.

The arrangement of the 36 half wave elements of an A.W. array is shown in Fig. 1. Each element is metallicallly supported at its centre point, the spacing from the wire netting reflector surface to centre line of each element being 13". The array is divided into three groups of 12 elements each, each group having a feed point as shown. A half wave element near the lower edge of the reflector is used as a monitoring dipole.

1.2. Feeder System.

Each feed point has a matching transformer (described below), which also acts as a balance-unbalance device, thus enabling co-axial feeder to be used. The latter is polythene feeder type PT12R, which has a characteristic impedance Z_0 of 85 ohms and an attenuation of 3.7 db/100 ft. This type is used throughout.

Each of the three non-resonant feeders is of equal length and runs to a common junction box as shown. A second junction box is used to enable a capacity stub (consisting of a piece of PT12R) to be suitably located on the main feeder for matching purposes. The junction boxes are a cast type having weatherproof entries. The braided sheath of each feeder is held on the inside of the box by means of a clip and the inner conductors are soldered together at a common point. All feeder is enclosed in 3/4" hose to provide extra protection.

1.3. Matching Arrangements.

The feeder system is shown schematically in Fig. 2. Dimensions A and B are adjustable to enable the aerial sections

to be matched to their respective feeders. For any position of the tap PP' (i.e. dimension A), a position can be found for the shorting bar (dimension D) which gives a purely resistive load on the end of the feeder. The manner in which the value of this resistance varies with "A" is shown in Fig. 3. The resistance increases as the tapping points are moved away from the feed point. Hence, a value of "A" can be found for which R is 85 ohms.

The impedance at Q is transformed to 85 ohms by adjustment of the dimensions C and D. Thus, by cutting the stub and the piece of feeder between the two junction boxes to the correct length, a match may be obtained.

The step-by-step procedure in making both the above matching adjustments is given later.

2. IMPEDANCE GEAR.

2.1. Description of Layout.

A brief description of the layout of the impedance gear is given to enable the method of adjusting and using it to be understood. Complete details are given in Technical Report RP.96 and Production Report P.D.4.

Fig. 4 shows the construction of the gear. It consists of a concentric line to one end of which a 200 Mc/s. battery oscillator is loosely coupled; a field strength receiver is used to measure the voltage across the input end of the line and is coupled through a short piece of concentric feeder to the connector B. The unknown impedance is tapped across the line (via the connector A) and the tapping position is variable in position. A short circuited quarter wavelength, shown in the diagram, eliminates the effect of the rest of the line to the right of A. The gear set up for measurement is illustrated in Fig. 5.

If the impedance connected across A is a resistance of 85 ohms, it matches the characteristic impedance of the gear and no variation of the receiver reading occurs as the position of A is varied up and down the line. If, however, the unknown impedance mismatches the gear, the standing wave system causes the receiver reading to pass through maxima and minima as the gear is operated.

A scale graduated in degrees enables the length of line between the input or oscillator end of the line and the position of A to be measured. On this scale 90 degrees is equal to $\frac{\lambda}{4}$. For the purpose of matching the array, however, only two points are required on the scale as described later. The positioning of this scale is determined during the aerial adjustments. Another fixed scale graduated in centimetres and millimetres is also provided.

Adjustments (1) and (2) to an inductance L_2 and to the length of the shorted $\frac{\lambda}{4}$ section respectively enable various stray effects to be tuned out. The procedure for doing this is given below.

2.2. Adjustment of the Impedance Gear.

The step-by-step adjustment of the impedance gear is as follows:

- (a) Adjust the oscillator frequency to 200 Mc/s., as indicated by the tuning dial of the receiver.
- (b) Set the coupling adjustments C_1 and C_2 to give fairly loose coupling. Accurate adjustment of these couplings is not required for the present purpose.
- (c) With the connector at A (Fig. 4) unconnected to any external impedance (i.e. open-circuited),

find the scale reading for which the receiver reads a minimum voltage. The centimetre scale may be used for this purpose. Then, find the scale reading for a maximum voltage and vary the adjustment (1) (i.e. by screwing the plunger through L_2 in and out) until it occurs $\frac{\lambda}{4}$ from the reading for a minimum. Note that $\frac{\lambda}{4}$ is 37.5 cm. at 200 Mc/s.

- (d) Short circuit the terminals A (by means of a disc of metal inside a female connector screwed on to A) and find the scale reading for a minimum voltage. Remove the short circuit and note the new reading for a minimum. Vary adjustment (2) (by releasing the locking screw - Fig. 4) until the latter reading is $\frac{\lambda}{4}$ from the reading obtained with the short circuit.
- (e) The positioning of the degree scale is determined during the aerial adjustments described below.

2.2.1. Impedance Measurements.

This section is not required for the purpose of matching the array. Its object is to describe briefly the more general case where the impedance gear is used to measure impedances.

When adjustments (a), (b), (c) and (d) are complete, the positioning of the scale remains. If the unknown impedance is connected directly to the terminals A, this adjustment is carried out by sliding the degree scale until the 180° mark is opposite the tuning position for a maximum when the terminals A are open circuited. If the unknown impedance is connected to A through a length of feeder of the same impedance as the gear, the scale is adjusted as

above, the open circuit, however, now being applied to the end of the feeder.

The quantities, which have to be observed to determine the unknown impedance, are then the scale reading θ for a maximum receiver reading and the ratio of

$$\frac{\text{minimum receiver reading}}{\text{maximum receiver reading}}$$
 expressed in decibels. The

latter quantity is obtained directly from the logarithmic scale of the receiver.

Charts have been prepared which express the resistance and reactance components of the unknown impedance in terms of these two quantities (Charts CXS14 and CXS15). Other charts give the unknown impedance in terms of a resistance component in parallel with a reactance component (Charts CXS16 and CXS17).

3. AERIAL MATCHING PROCEDURE.

The length of feeder between the tapping points PP' and the first junction box at Q (Fig. 2) for that aerial section which requires the longest feeder should be determined. Three equal feeders may then be cut to this length and fitted to their respective matching sections. The latter should then be clamped in position on the array and the feeders inside 3/4" hose laid to the feeder box.

Matching adjustments are best made with the impedance gear on the ground level owing to the limited aerial platform space. This necessitates the use of an extension feeder between the impedance gear and the end of the feeder being matched. The main feeder may conveniently be used for this purpose..

3.1. Adjustment of Feeder Length and the Positioning of the Impedance Gear Scale.

1. Connect one end of the extension feeder to one of

the junction boxes in the feeder box, and the other end to the impedance gear at A by means of an Amphenol connector. Connect one of the matching section feeders to the junction box and make the joint to the extension feeder.

2. Place a short circuiting sheet of metal on the end of the feeder between the points PP' (Fig. 2) and note the scale reading for a maximum voltage reading. Disconnect the feeder from the junction box and repeat the procedure for the other two feeders in turn; shorten the longer ones so that they all give the same reading for a maximum when short circuited as described. It may be noted that when two readings differ by 6° on the impedance gear scale (about 1"), the longer feeder should be shortened by about 0.7". However, when equalising the feeders it is wise to be conservative in estimating the amount of feeder to be cut off.

3. Slide the degree scale until the 90° mark is opposite this common tuning position. If the scale does not come in a convenient position, shorten the common feeder by a few inches. Then, the 90° and 180° graduations represent the positions at which the gear tunes for a maximum, when the feeder terminating impedance is a pure resistance; if it tunes at 180° , the terminating resistance is greater than 85 ohms (the characteristic impedance of the gear), and if it tunes at 90° , the resistance is less than 85 ohms. When reactance is present, the tuning position occurs between these two values.

3.2. Matching the Aerial Sections.

4. Remove the shorting strips used in the previous adjustment and connect one of the three feeders to the extension feeder using the junction box to make the connection as described above.

5. Set the dimension A (Fig. 2) of the matching section being adjusted at about 5 inches and dimension B at about 25 inches. Find the scale reading for a maximum and proceed to adjust the position of the matching section shorting bar until this reading is either 90° or 180° . When this occurs, the impedance terminating the feeder is a pure resistance and its value may be found by noting the ratio

$$\frac{\text{minimum receiver output reading}}{\text{maximum receiver output reading}} = \frac{V_{\min}}{V_{\max}}$$

as the gear is operated. Then the terminating resistance R is

$$R = 85 \sqrt{\frac{V_{\min}}{V_{\max}}} \quad \text{when max. reading occurs at } 90^\circ$$

$$R = 85 \sqrt{\frac{V_{\max}}{V_{\min}}} \quad \text{when max. reading occurs at } 180^\circ$$

that
This shows/if $V_{\min} = V_{\max}$ (i.e. no rise and fall of receiver reading as the gear is operated), the feeder is matched. Otherwise, R is too large if the maximum reading occurs at 180° and the dimension A must be reduced as may be seen from Fig. 3. If, however, the maximum reading is at 90° , A should be increased.

6. Having adjusted A to a new value as determined by the above, proceed to re-adjust the shorting bar, until the scale reading for a maximum again occurs at the resonance points, 90° or 180° . The ratio of $\frac{V_{\min}}{V_{\max}}$ should now be

nearerto 1. This procedure should be repeated until

$\frac{V_{\min}}{V_{\max}}$ is greater than about 90%, this figure representing

a 5% mismatch. When the matched condition is being

approached, the linear scale of the receiver should be used, as this is more sensitive.

The steps (4), (5) and (6) should now be repeated for the other two aerial section feeders. All three aerial sections should now be matched.

3.3. Matching to the Main Feeder.

7. Connect the three aerial feeders, the main feeder and an open ended matching stub to the junction boxes in the feeder box in accordance with Fig. 2. The theoretical values of the dimensions C and D are:-

$$C = 3.1/2''$$

$$D = 5.3/4''$$

8. Connect the lower end of the main feeder to the impedance gear and place a short circuit at the upper end at the point R. Note the scale reading for a maximum. Slide the degree scale until the 90° mark is opposite this reading. Remove the short circuit and determine by trial and error a length of matching stub which causes the impedance gear to tune at either the 90° or 180° positions. Note the ratio $\frac{V_{min}}{V_{max}}$ and if this is greater than about 70%, the adjustment may be considered satisfactory.

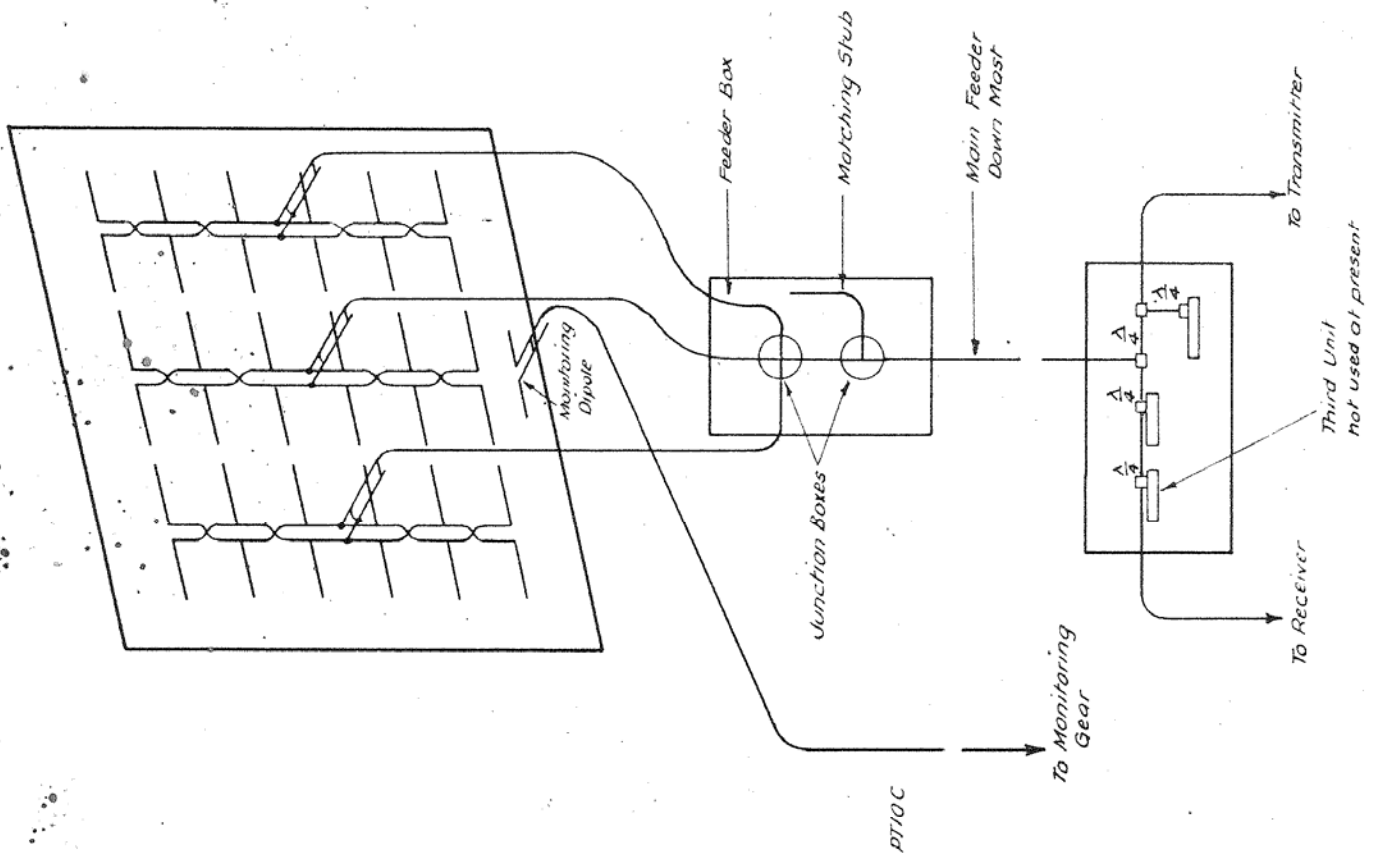
9. If this is not so, increase the dimension C, if maximum reading is at 90° and decrease C if the reading is at 180° .

10. Re-adjust the stub length until the terminating impedance is a pure resistance again; the feeder should now be more closely matched. This procedure may be repeated until $\frac{V_{min}}{V_{max}}$ is greater than 70%.

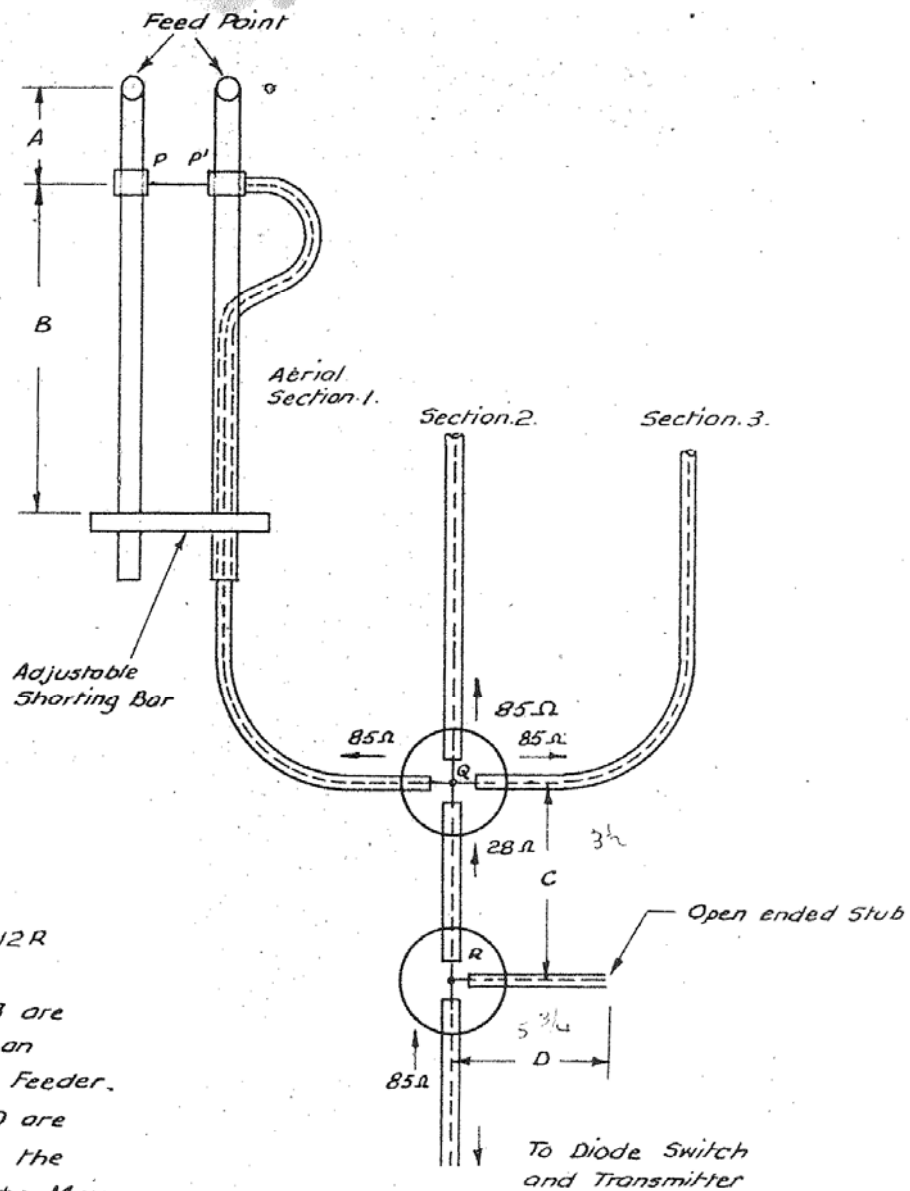
When the adjustment is complete, the open end of the stub and the points Q and R should be examined to ensure that the clearances to earth are satisfactory. These may be tested by putting the transmitter power on the aerial system and searching for sparking to earth.

3.4. Adjustment of the Array Without Impedance Gear.

When a few arrays have been set up, it should be possible to match the aerial sufficiently closely by cutting the feeders to equal physical lengths and by setting the dimensions A, B, C and D to standard values. These dimensions will be added as they become available, providing that experience shows that this procedure is adequate.



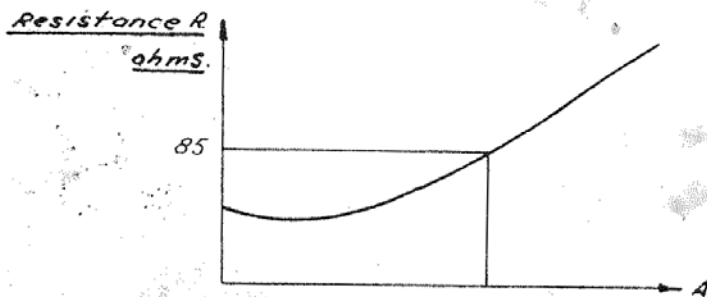
				R. P. - C. S. I. R.			
				P.D. 17 FIG. 1.			
1		25-3-42		SCALE			
NO.	DATE	APPROVED	NOTES	PASSED	DRAWN	6.4.4	
ISSUES				DATE: 25-3-42	CHECKED	H. 7.1	
				D		2254	



NOTES

All Feeders are PT12R
 $Z_0 = 85 \text{ ohms.}$
 Dimensions A and B are
 adjusted to match an
 Aerial Section to its Feeder.
 Dimensions C and D are
 adjusted to match the
 impedance at Q to the Main
 Feeder

				R. P. — C. S. I. R.			
				P.D. 17			
				FIG. 2			
				SCALE			D
				PASSED	DRAWN	10/11/11	
				10/11/11	TRACED		
				DATE:	CHECKED	11/11/11	
1	25-3-42	10/11/11					
NO.	DATE	APPROVED	NOTES				
ISSUES							
				2255			



R is the resistance on the end of the feeder after
tuning out reactance by means of the shorting bar.

R. P. — C. S. I. R.

PD 17

FIG 3

SCALE

PASSED

DATE

DRAWN

TRACED

CHECKED

P

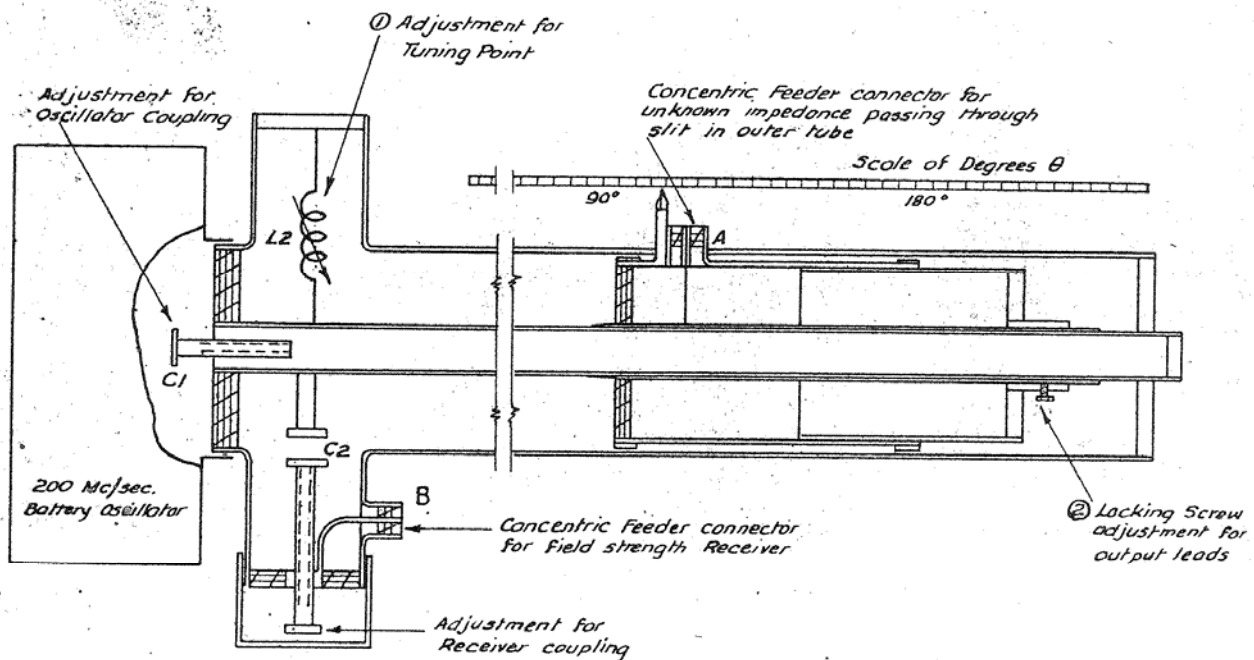
2256

1 25-3-42

APPROVED

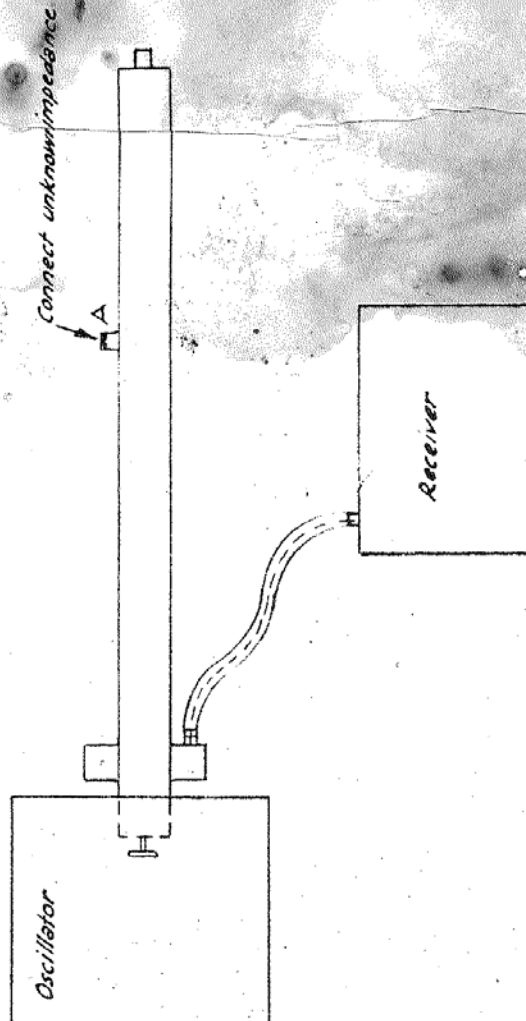
NOTES

ISSUES



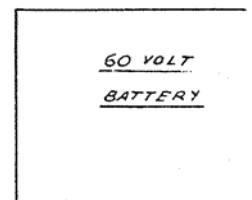
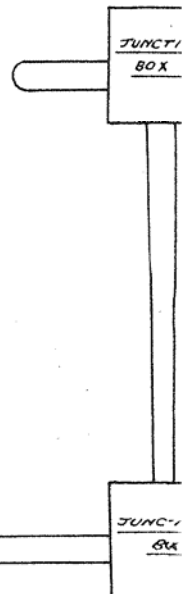
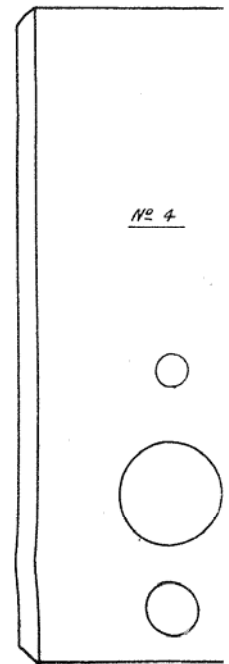
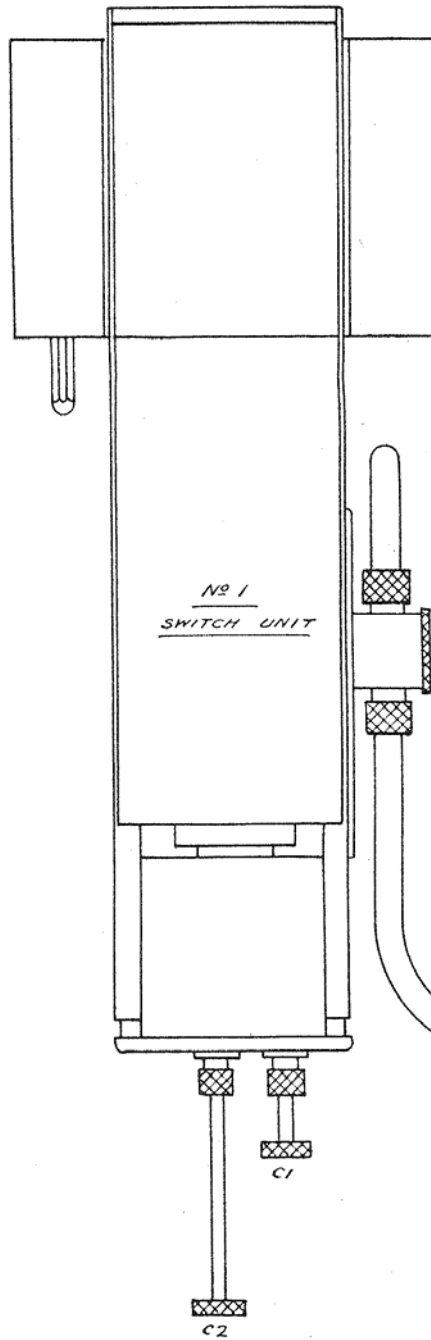
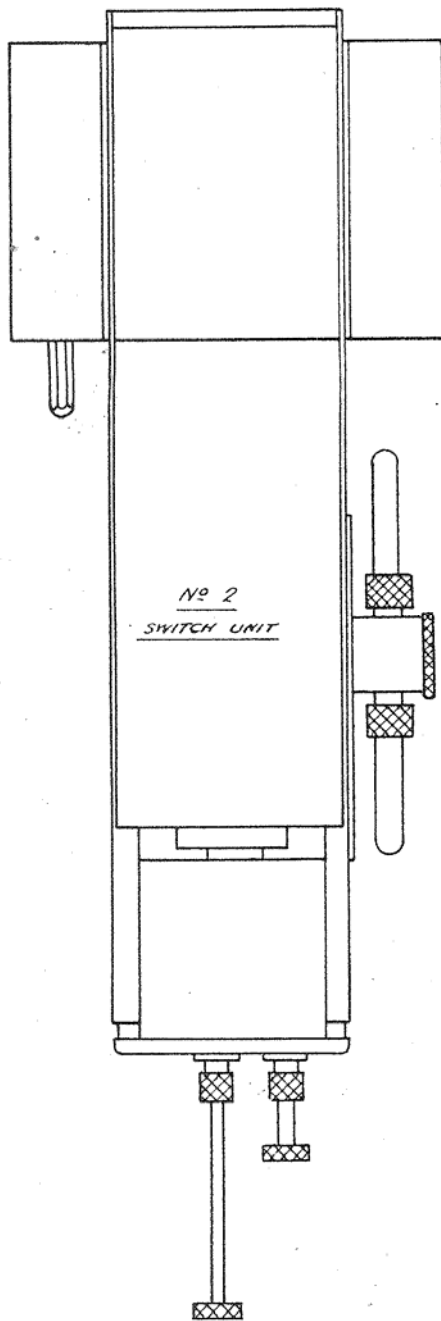
NOTE: Trolital shaded thus 

				R. P. - C. S. I. R.			
				P.D. 17			
				FIG. 4.			
1		25-3-42	89/B	SCALE		D	2257
NO.		DATE	APPROVED	PASSED	DRAWN		
				89/Brown	TRACED		
				DATE:	CHECKED		
ISSUES							

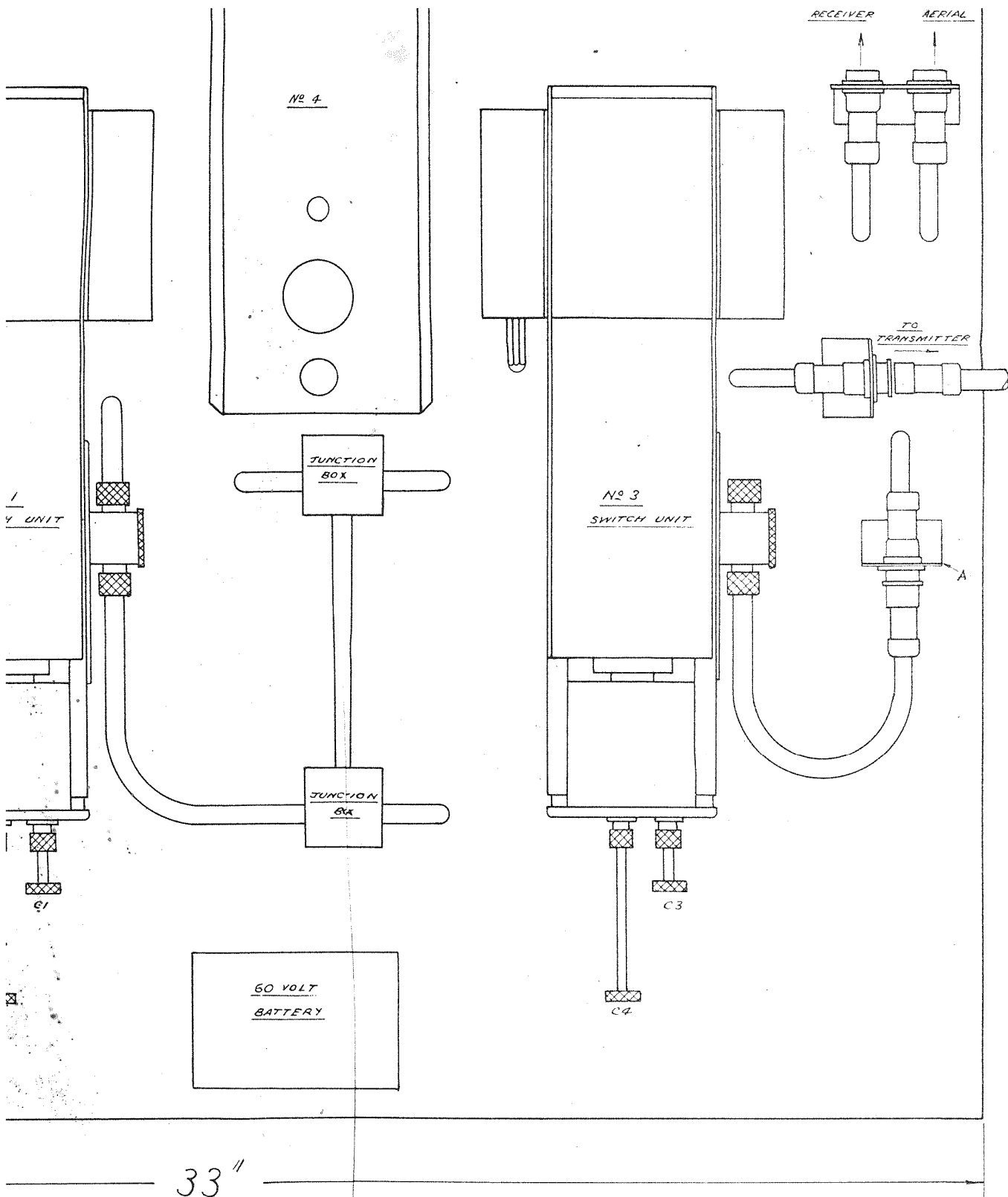


				R. P. — C. S. I. R.		
				REPORT RP/96/1, FIG. 9 ALSO P.D.17, FIG. 5.		
				SCALE	PASSED	DATE
				N. TO S.	<i>[Signature]</i>	10-6-41
				DRAWN	LP	P 701
				TRACED		
				CHECKED	<i>[Signature]</i>	
NO.	DATE	APPROVED	NOTES	ISSUES		
1.	10-6-41	<i>[Signature]</i>				

26"



33"

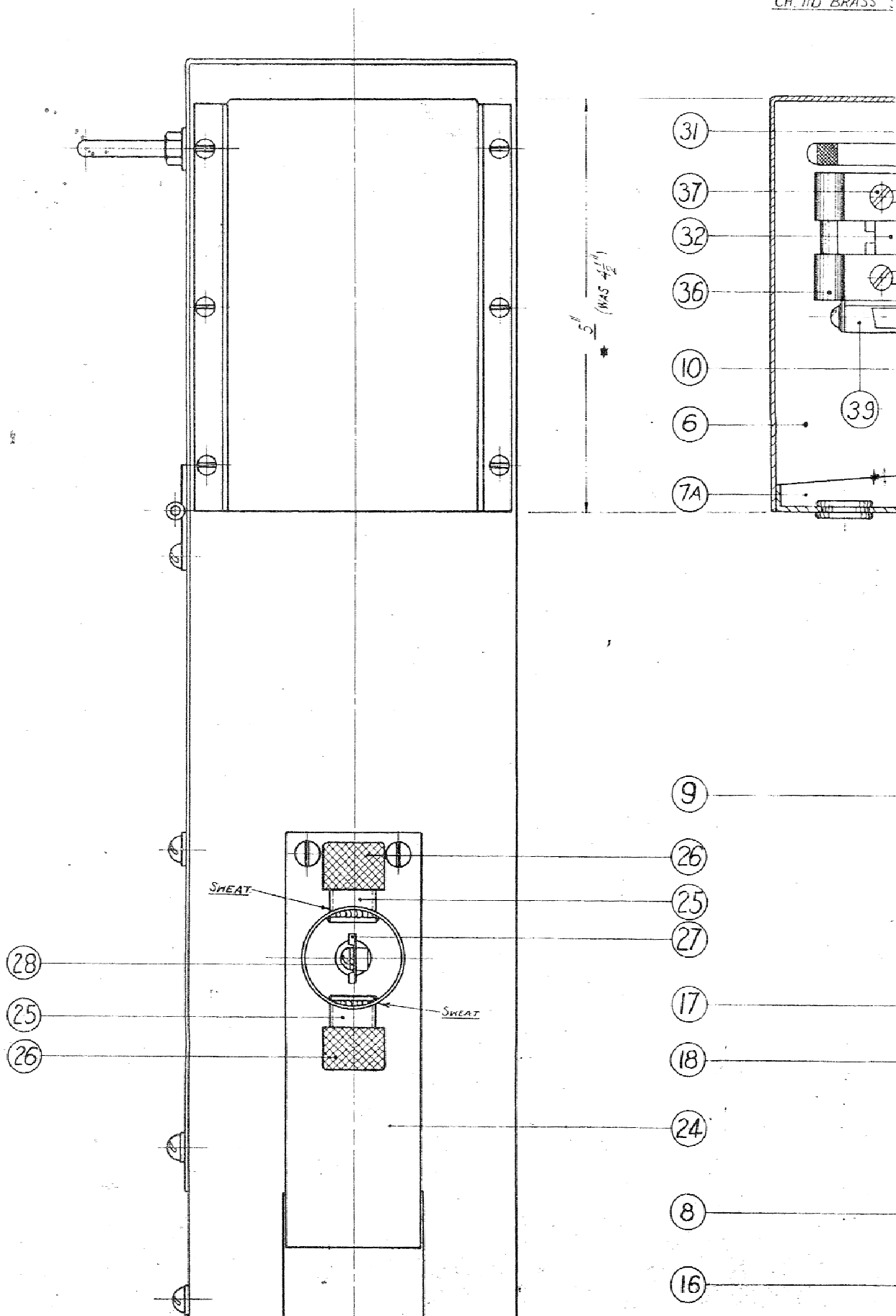


				ITEM	DESCRIPTION		ORG. NO.	REQ.	MATE
				R.P. — C.S.I.R.					
				PD 17					
				FIG 6					
				SCALE					
				PASSED		DRAWN			
				TRACED		M. S.			
1	1-4-42								
NO.	DATE	APPROVED	NOTES						

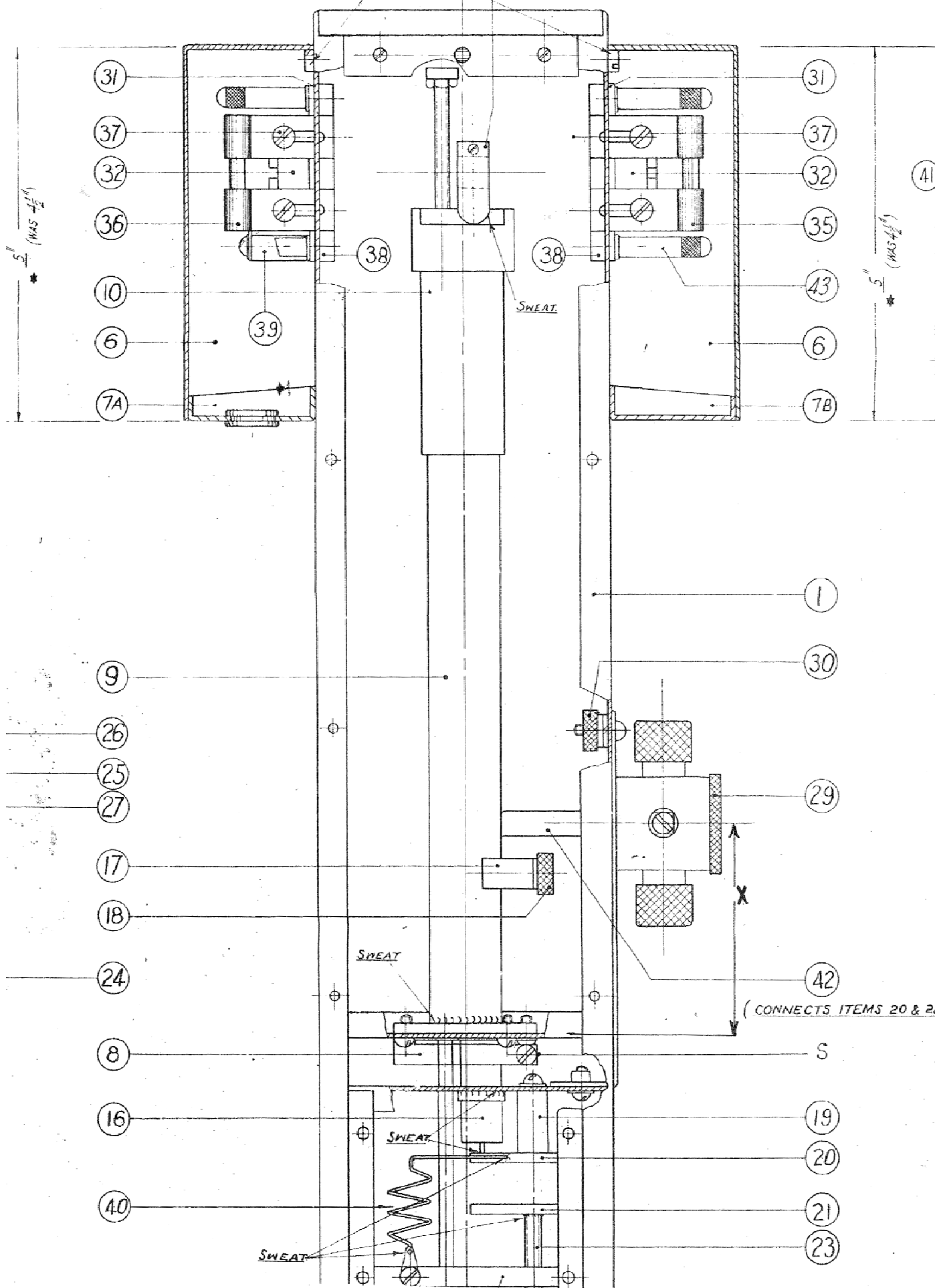
C

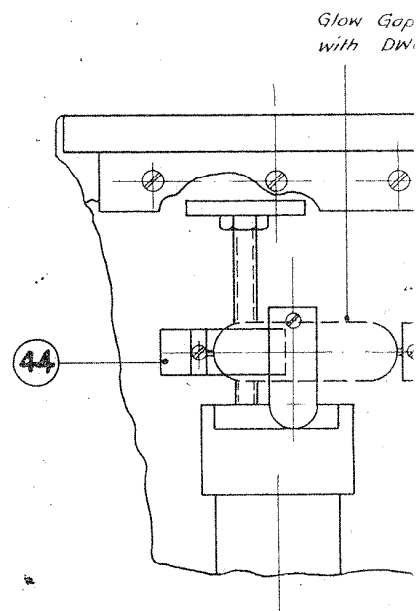
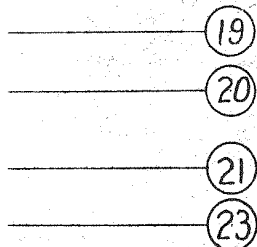
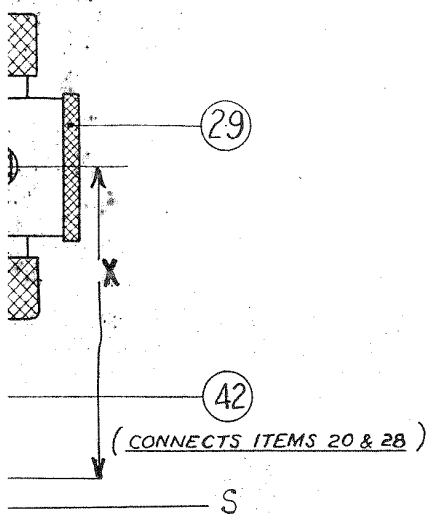
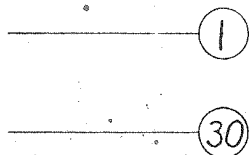
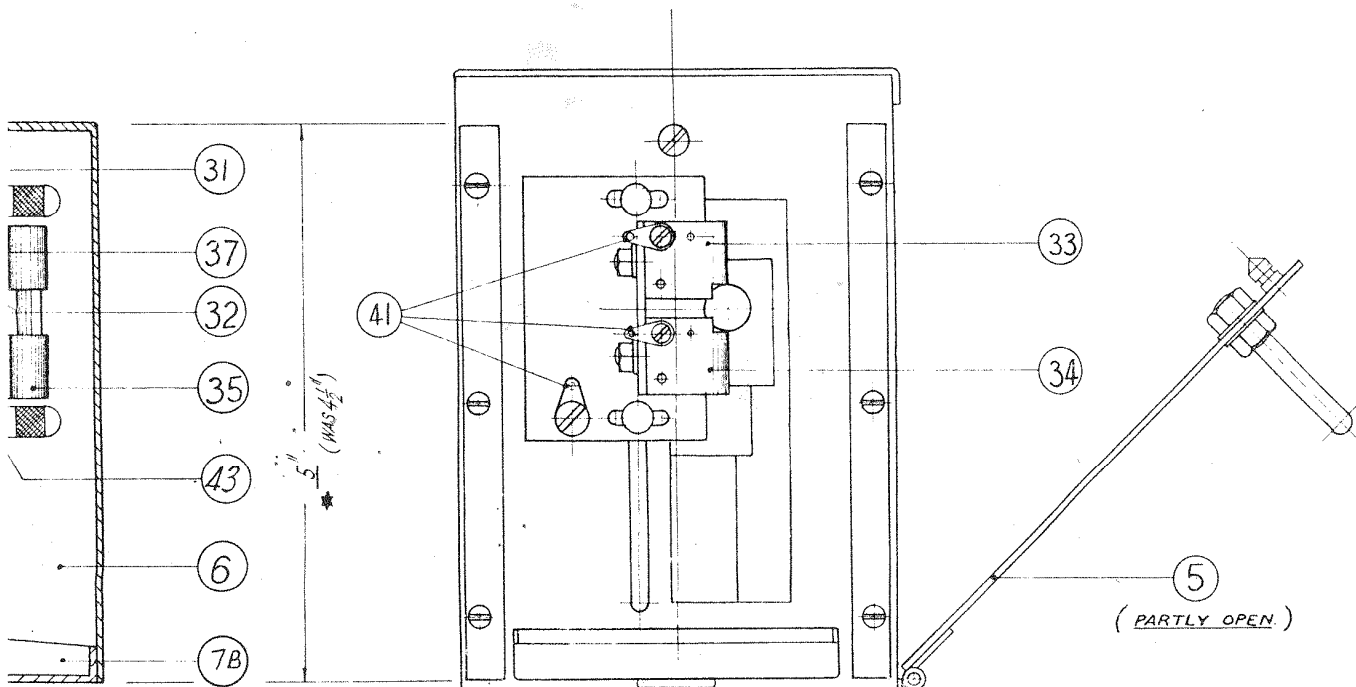
2298

STOP FOR ITEM
CH. 110 BRASS

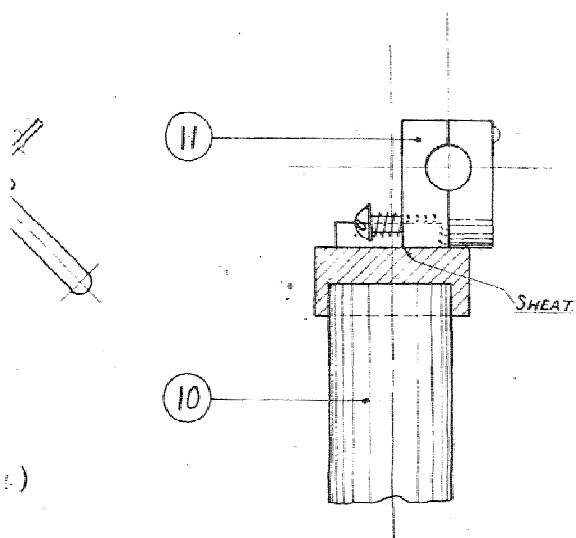


STOP FOR ITEM 6 (SCREW N° 5BA
CH. HD BRASS SWEATED IN)

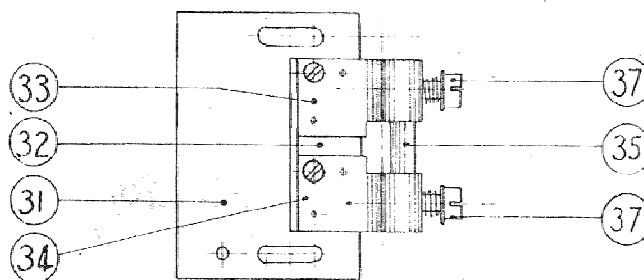




DETAIL SHOWING POS.
 ADAPTORS. ITEM:

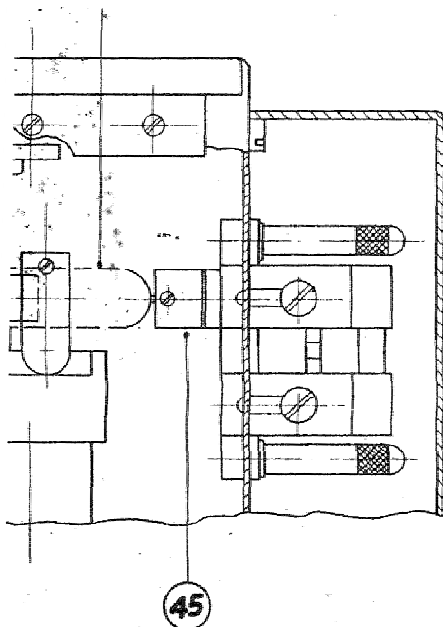


DETAIL SHOWING ASSEMBLY
OF ITEMS 10, 11



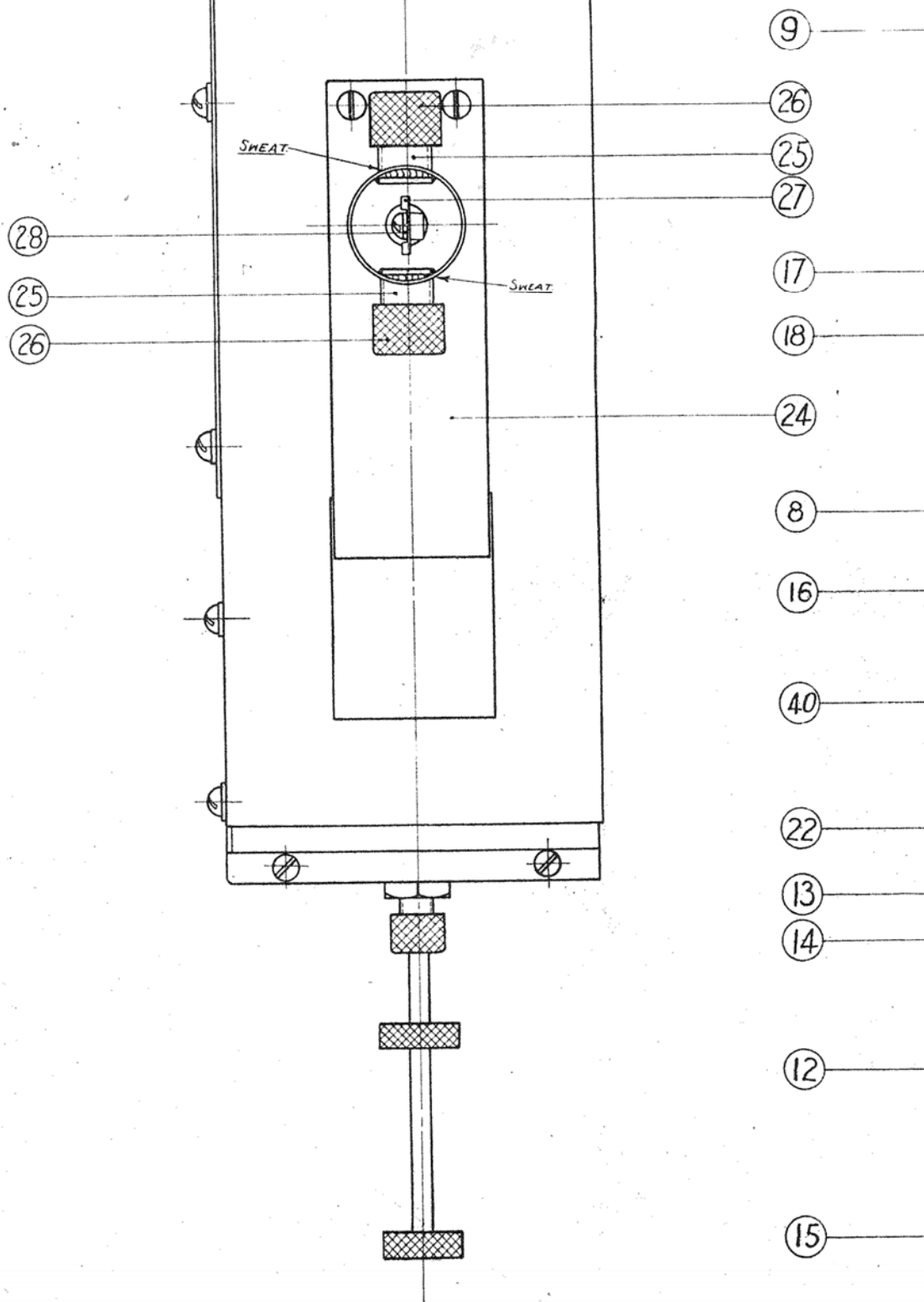
DETAIL SHOWING ASSEMBLY
OF ITEMS 31, 32, 33, 34, 35, 37

Glow Gap in accordance
with DWG. D1797



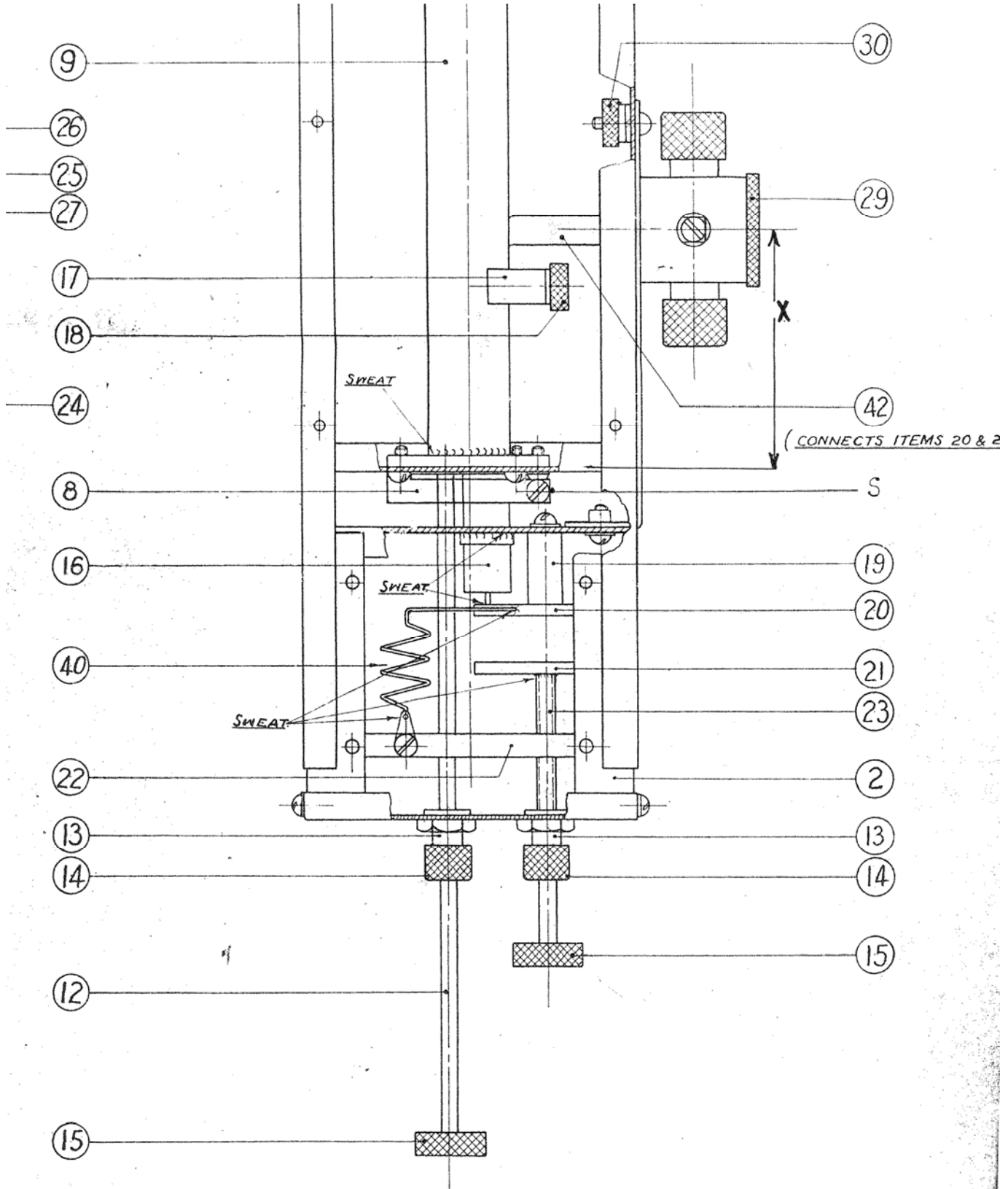
SHOWING POSITION OF GLOW GAP
ADAPTERS. ITEMS 44 & 45

45	GLOW GAP ADAPTER	P2220	1	BRASS
44	GLOW GAP ADAPTER	P2219	1	BRASS
43		P1965	4	BRASS
42	CABLE TYPE "PT 100" (LESS SHIELD)		1	
41	CONNECTION TAG		5	TND COPPER
40		P964	1	COPPER
39		P963	1	EBONITE
38		P962	2	BRASS
37		P961	4	"
36		P960	1	"
35		P960	1	"
34		P959	2	"
33		P958	2	"
32		P957	2	TROLITUL
31		P956	2	BRASS
30		P955	2	"
29		P954	1	"
28		P953	1	COPPER
27		P952	1	"
26		P951	2	BRASS
25		P950	2	"
24		P949	1	"
23		P948	1	"
22		P947	1	"



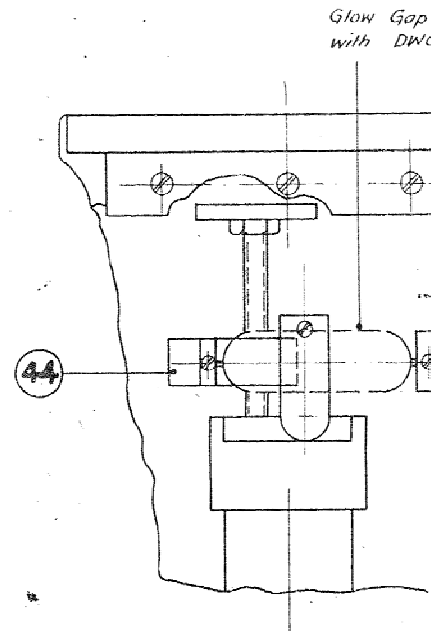
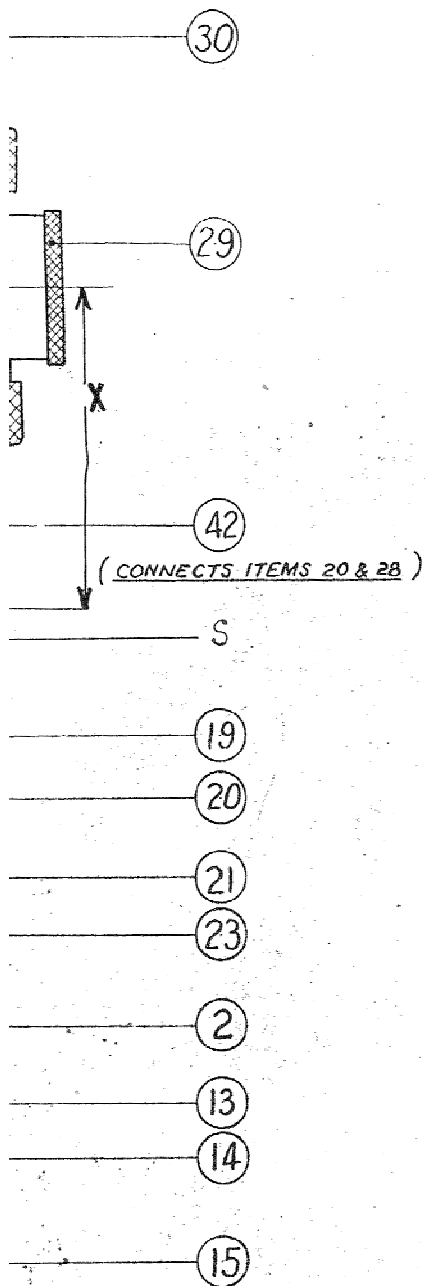
RIGHT

ITEM 29 REMOVED



FRONT

ITEMS 4 & 5 REMOVED



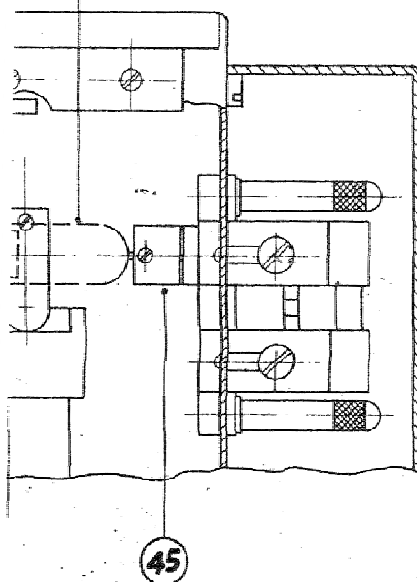
DETAIL SHOWING POS
ADAPTORS. ITEM.

NOTE 1. FIT SPRIN
RD. HD. SCR.
2 EXPOSED
ITEMS TO
GREY COLOU
IS COMPLE

LEFT
ITEMS 6, 36, 37 REMOVED.

4	30.3.42
3	14.2.42
2	5.11.41
1	21.8.41
NO.	DATE

Glow Gap in accordance
with DWG. D1797



LOWING POSITION OF GLOW GAP
TORS. ITEMS 44 & 45

1. FIT SPRING WASHERS TO ALL
RO.HD. SCREWS
2. EXPOSED SURFACES OF COPPER PLATED
ITEMS TO BE SPRAYED WITH DUCO SILVER
GREY COLOUR N°286/311 AFTER ASSEMBLY
IS COMPLETED.

45	GLOW GAP ADAPTER	P2220	1	BRASS
44	GLOW GAP ADAPTER	P2219	1	BRASS
43	—	P1965	4	BRASS.
42	CABLE TYPE "PT 10C" (LESS SHIELD)		1	
41	CONNECTION TAG		5	TND COPPER
40	—	P964	1	COPPER
39	—	P963	1	EBONITE.
38	—	P962	2	BRASS
37	—	P961	4	"
36	—	P960	1	"
35	—	P960	1	"
34	—	P959	2	"
33	—	P958	4	"
32	—	P957	2	TROLITUL
31	—	P956	2	BRASS
30	—	P955	2	"
29	—	P954	1	"
28	—	P953	1	COPPER
27	—	P952	1	"
26	—	P951	2	BRASS
25	—	P950	2	"
24	—	P949	1	"
23	—	P948	1	"
22	—	P947	1	"
21	—	P946	1	"
20	—	P945	1	"
19	—	P944	1	TROLITUL
18	—	P943	1	BRASS
17	—	P943	1	"
16	—	P942	1	"
15	—	P941	2	"
14	—	P940	2	"
13	—	P939	2	"
12	—	P938	1	"
11	—	P937	1	"
10	—	P936	1	"
9	—	P935	1	"
8	—	P934	1	"
7A-7B	—	P933	2	MILD STEEL
6	—	D932	2	"
5	—	D931	1	"
4	—	D930	1	"
3	—	D930	1	"
2	—	D929	1	"
1	—	B928	1	"
ITEM	DESCRIPTION	DRG. NO.	REQ.	MATERIAL

4	30.3.42	<i>12/2</i>	ITEMS 44 & 45 ADDED
3	14.2.42	<i>RFB</i>	ITEM 43 ADDED.
2	5.11.41	<i>12/12</i>	VARIED THUS *
1	21.8.41	<i>FJBW</i>	
NO.	DATE	APPROVED	NOTES

ISSUES

R.P. — C.S.I.R.

"U334" P.D.17
GENERAL ASSEMBLY. FIG. 7.

SCALE

PASSED

DRAWN

TRACED

CHECKED

F.M.C.
19.8.41

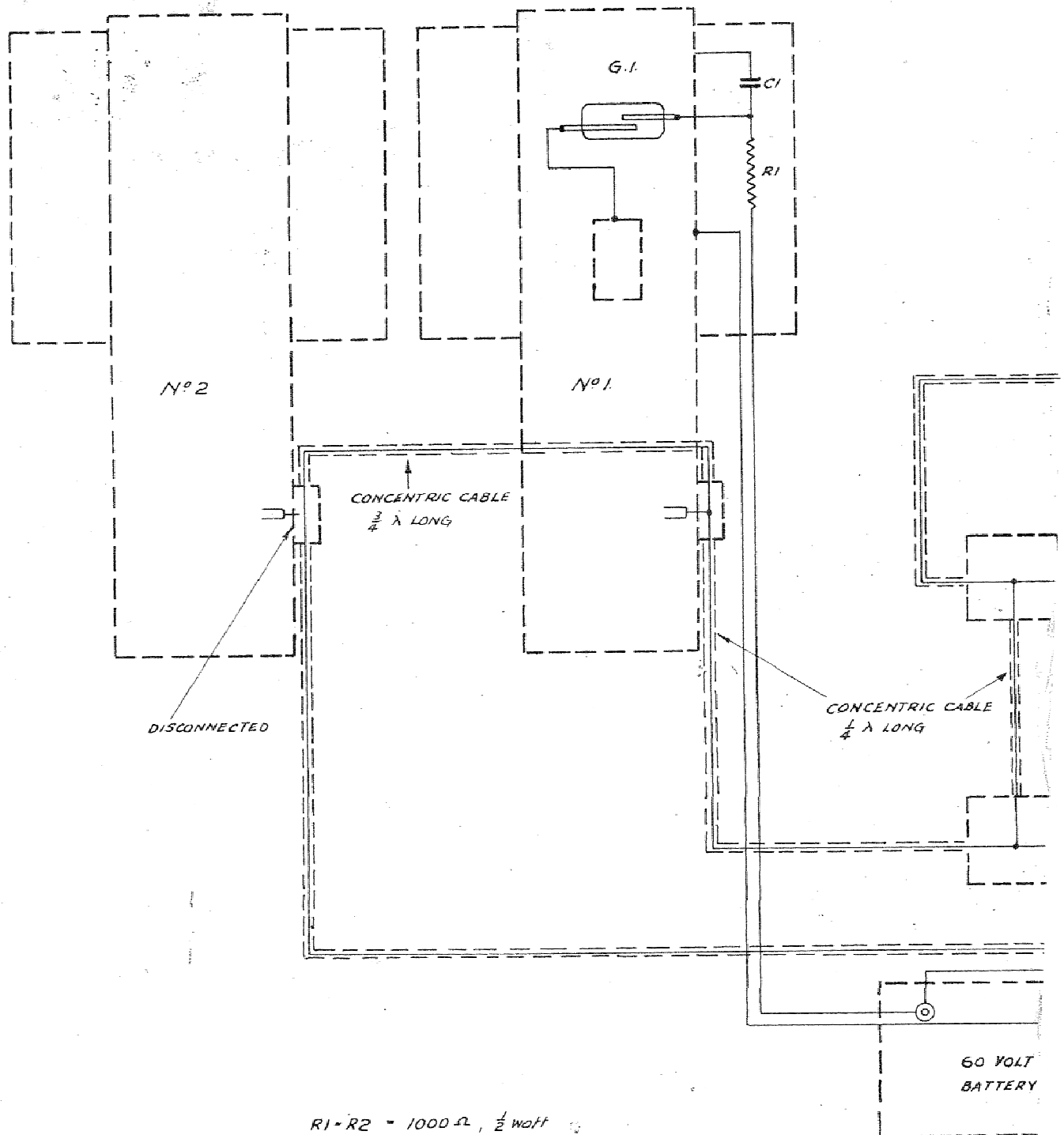
M.S.
27.10.41

M.M.L.

B

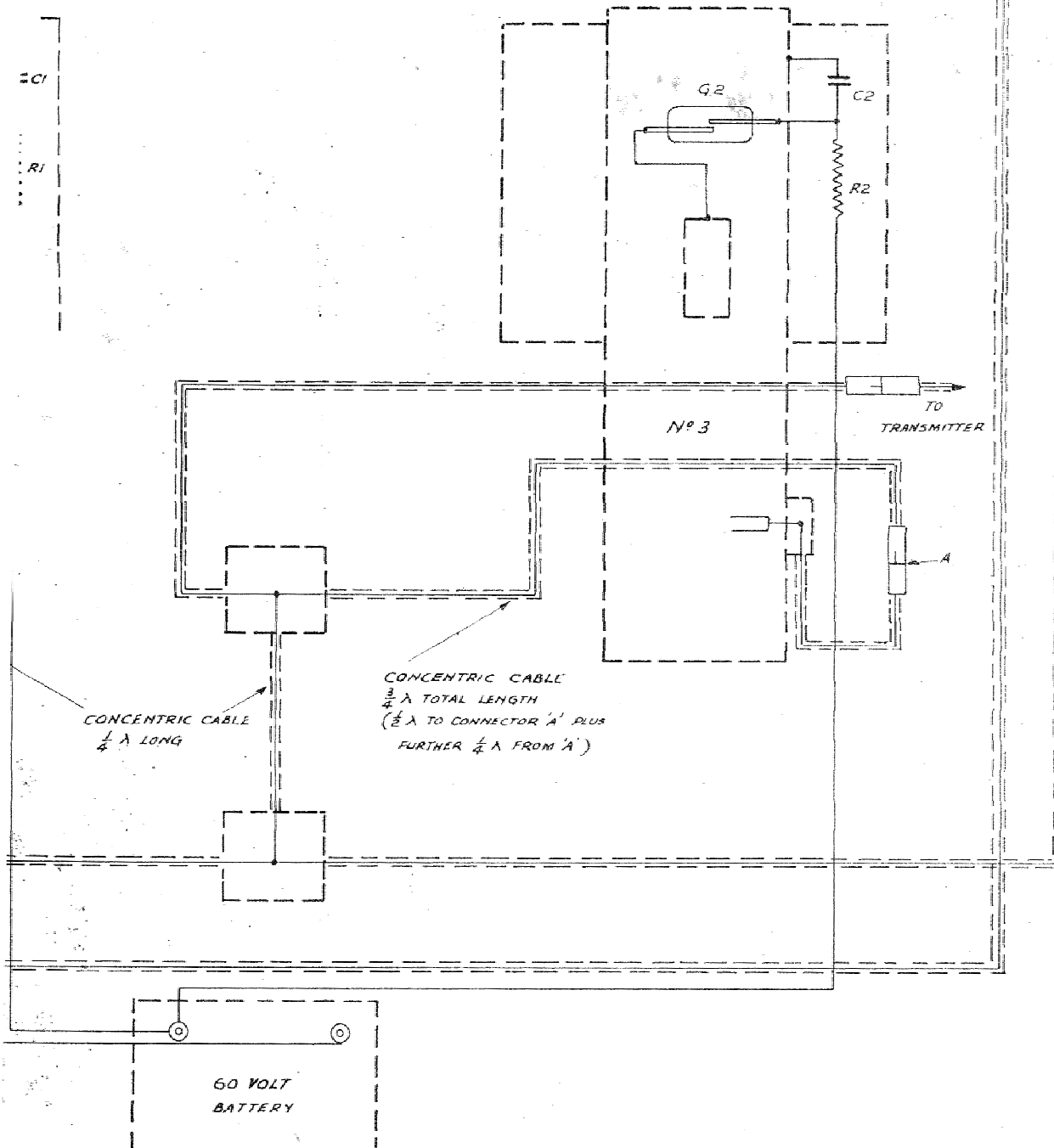
927

DATE 1984/



$R1 \cdot R2 = 1000 \Omega, \frac{1}{2} \text{ watt}$
 $C1 = C2 = 100 \mu\text{F}, 400 \text{ working}$
 $G1 = G2 = \text{RPGI Glow Gap}$

CIRCUIT D,
VIEWED FROM



CIRCUIT DIAGRAM
VIED FROM FRONT

ITEM	DESCRIPTION	ORG. NO.	REQ.	MATERIAL
R. P. — C. S. I. R.				
<i>P. D. 17</i>				
<i>FIG. 8</i>				
SCALE				
PASSED		DRAWN		
		TRACED		<i>B-N-N</i>
TE.		APPROVED		NOTES

C 2299

AIR WARNING SET J.23.T.R. SWITCH USING R.P.G.1 GLOW GAPSPart III1. PURPOSE & LAYOUT.

The purpose of the T.R. switch is to allow the use of the one aerial for both transmitting and receiving. The automatic switching necessary can be performed by either diodes, spark gaps, or glow gaps. The switching action of all three depends upon their characteristic of offering a high resistance to low R.F. voltages (non-conducting state) and a low resistance when high R.F. voltages are applied (conducting state). When the T.R. switch is correctly tuned and adjusted, it performs the following duties:

1. Allows the main part of the transmitter power to flow to the aerial.
2. Blocks the main part of the R.F. voltage of the transmitter pulse from reaching the receiver, thus protecting the first valve of the receiver.
3. Causes most of the received echo voltage to pass to the receiver, preventing its waste in the transmitter.

The layout of the T.R. switch is shown in Fig. 6. This shows three switch units designated No. 1, No. 2, and No. 3. No. 2 unit is not used however, and has to be disconnected from the circuit. This is done by taking out the screw which presses the lug (Item 28, Fig. 7) into contact with the lug (Item 27, Fig. 7). Lug 28 might have to be bent away from lug 27, in order to produce a definite separation. Item 4 (Fig. 6), which houses a transformer and meter, is not used, as well as certain resistors and condensers in No. 1 and No. 3 switch units. The components actually being used are shown in the circuit diagram (Fig. 8).

2. FITTING GLOW GAPS RPGL.

The T.R. switch was designed to use diodes (RPV1). In order to use the RPGL glow gaps supplied with the T.R. switch, it

is necessary to fit the glow gap adaptors (items 44 and 45 of Fig. 7). These are shown together with the glow gap in the photograph (Fig. 9). This shows the method of mounting. Glow gaps are fitted to both No. 1 and No. 3 units.

3. TRANSFORMATION RATIO ADJUSTMENT.

This ratio can be altered as follows: Remove the cover (item 5, Fig. 7) by undoing the six screws. Loosen the two clamps (item 30), the clamp (item 18), the screw (marked "s") and the lock nut (item 14) on the spindle (item 12). Then item 2 will be free to slide with respect to the main body of the switch unit. Its position should be adjusted, so that the distance marked "x" in Fig. 7 is 1.5 inches.

4. EXTERNAL CONNECTIONS TO T.R. SWITCH.

These are three in number, viz.

1. Concentric cable from transmitter.
2. Concentric feeder cable to aerial.
3. Concentric cable to receiver.

These connections are all made through concentric connectors, and their locations are all clearly marked in Fig. 7 and Fig. 6.

N.B. No connection to the 240 volt supply is required. This is connected only when RPY1 diodes are used in the T.R. switch.

5. TUNING ADJUSTMENTS.

1. Before switching on the transmitter, disconnect the concentric line from the input of the receiver and connect it to the monitoring peak valve volt meter.
2. Disconnect the junction (A, Fig. 6) on the T.R. switch.

3. Switch on the transmitter and adjust the suppression condenser (C1, Fig. 6) until the valve voltmeter shows a minimum voltage (this ought to be approximately 25 volts).
4. Disconnect the receiver input line from the peak valve voltmeter and connect it in its normal position on the receiver.
5. Find an echo (a fixed one is usually the more satisfactory because of its freedom from fluctuations. Adjust the control (C2, Fig. 6) for maximum echo strength.
6. Connect the peak valve voltmeter to the monitoring dipole feeder. Re-connect the junction (A, Fig. 6). Adjust the control (C3, Fig. 6) on No. 3 unit for maximum reading on the valve voltmeter.
7. Find an echo and adjust the control (C4 Fig. 6) on No. 3 unit for maximum echo strength.

When the above adjustments have been made, the T.R. switch will be properly tuned.

6. MAINTENANCE.

Mainly due to possible transmitter frequency variation, it is necessary to check periodically the preceding adjustments. This is most important with adjustment No. 3, as any off tuning here results in a dangerously high voltage reaching the receiver, with the consequent destruction of the first valve of the receiver. It is advisable that all tuning adjustments on the T.R. switch should be checked daily.

The RPGL glow gap has incorporated inside its envelope

powdered glass which is coated with polonium, the radioactivity of which is employed to produce quick striking of the gap. Sometimes, especially when the glow gap is disturbed in any way, the powdered glass flies up into the discharge, resulting in brilliant white flashes of light which flicker spasmodically along the electrodes. This disturbance might continue for some minutes, but will finally die out. This occurrence must not be taken as an indication of a failure of the glow gap.

The drain on the 60 volt battery in the T.R. switch is quite small (of the order of 0.1 milliamps). The voltage required in the circuit is not critical and it may drop to 50 volts without any bad effect. The battery voltage should be checked weekly and should be renewed when it drops below 50 volts.

FIGURE 9

PHOTOGRAPH SHOWING MOUNTING OF GLOW GAP ADAPTORS

AND FITTING OF GLOW GAP

